MUNICIPAL ENGINEERING

The World's Leading Municipal Publication.

THE MINNEAPOLIS PARK SYSTEM.
Bathing Beach at Lake Calhoun.

VOL. XLIV. JANUARY, 1913. No. 1.

Nothing has such power to broaden the mind as the ability to investigate systematically and honestly all that comes under one's observation. The function of this publication is to place before its subscribers articles of such importance and value that their knowledge may be enriched by reading about the accomplishments of others in the same and allied fields of endeavor.

Published by

New York Office:
1125 World Bldg.

Engineering Publishing Co.
INDIANAPOLIS, IND.

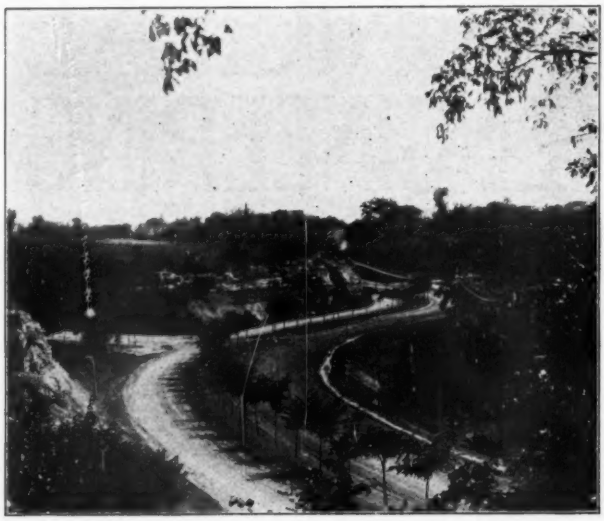
Chicago Office:
1945 Com'l Nat'l Bank Bldg.

Entered at Postoffice, Indianapolis, as Second-Class Matter.

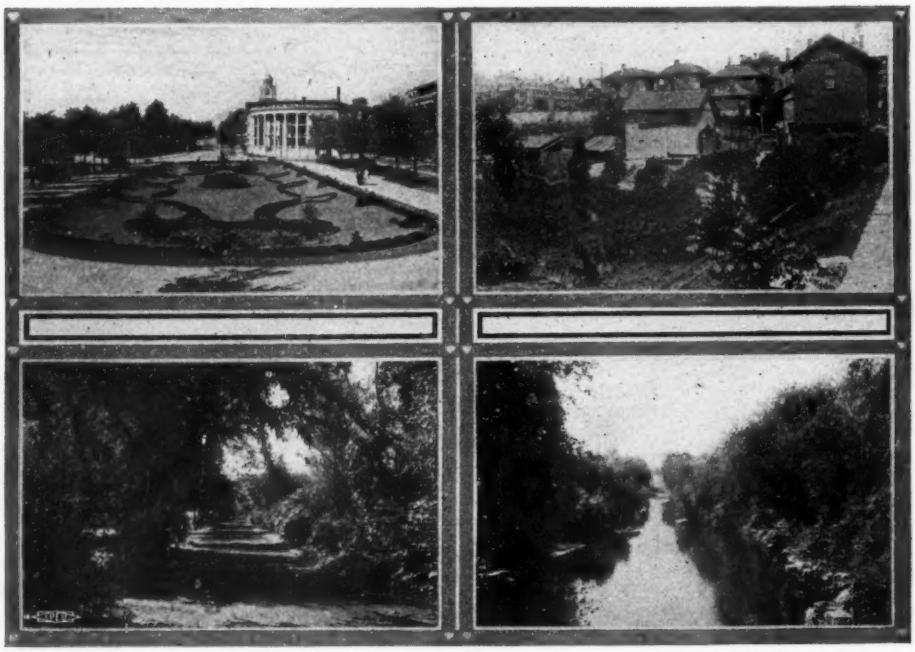
Russell Fortune, Prest. **C. C. Brown, Editor.** **C. S. Sale, Mgr.**

Subscription Price in U. S. and Possessions, Cuba and Mexico, $2.00. Canada, $2.40. Foreign, $2.75.

Changes of address, subscriptions, remittances and editorial matter should be addressed to MUNICIPAL ENGINEERING, Indianapolis, Ind.



KANSAS CITY PARK SYSTEM.
TRAFFIC ROADWAY, ON THE LEFT.
PENN VALLEY PARK, BOULEVARD, AND HEAVY



KANSAS CITY PARK SYSTEM.
PASEO BEFORE AND AFTER IMPROVEMENT.
SUNKEN GARDEN. BEFORE IMPROVEMENT.
WALK. LAKE.

KANSAS CITY PARK SYSTEM.
Swope Park Entrance and Shelter House.
Public Bath House. Gladstone Boulevard.

JAMES H. LOWRY, the executive officer of the Department of Public Parks, of Indianapolis, Ind., is a young man, a graduate of Purdue University, Lafayette, Ind., and for four years a member of the faculty of that institution. He has had experience in the construction of concrete buildings and in heavy railroad construction as engineer, and is giving eminent satisfaction as an executive officer under the general supervision of George E. Kessler, the landscape architect, and the direct charge of the members of the Indianapolis Board of Park Commissioners. His clear statement of the organization and results of Mr. Kessler's work in Kansas City shows that he has a large view of the work in which he is engaged.

UNDER the old feudal system, which flourished during the mediaeval history of Europe, the manor or castle naturally became the center of culture, the court the retreat of the philosopher, the poet, the artisan and the artist. Money was expended lavishly to beautify the exterior and interior of the edifice and the surrounding grounds became the canvas on which the landscape artists and gardeners worked out their dreams.

As the city might be presumed to be the outgrowth of these early centers, likewise, we imagine the modest efforts of these early gardeners to be revealed and expressed today in the magnificent park and boulevard systems in the modern European city, which pay a silent tribute to the temperament of the citizens.

Tourists in visiting the continent are deeply impressed with the universal interest in city planning and beautification. Millions are spent in carrying the beauties of nature to the hearts of the cities and the conservation of streams, the establishing of playgrounds and parks become logical and important parts of the city growth.

America has focused her intellect and energy upon commercial and industrial development of the cities, and the general recognition of civic beautification has been noticeably lacking.

The good roads movement, the city planning leagues and improvement associations, supported by a liberal-minded minority, have been instrumental in educating the public to the necessity of parks

and boulevards, and in some states legislation favorable to this movement has been enacted. As a result of this impetus many American cities boast of systems which are close rivals to those of their sister cities across the Atlantic.

Kansas City is an excellent type of this class, justly priding itself on a system in the logical sense of the word. Parks, parkways and playgrounds, embracing about nineteen hundred acres, are tied together in a very unique manner by a chain of boulevards over fifty miles in length. With only about three hundred thousand population, ten million dollars has been expended on the park development, or about thirty-five dollars per capita.

The topography of the city is ideal, being very rolling, thereby affording an excellent opportunity for a series of upper and lower side-hill drives, which have been worked out very nicely. The picturesque and famous side-hill Cliff drive, about four miles in length, with its rugged vine-clad cliffs of native limestone rising sixty feet from the roadway, overlooking the broad lowlands of the Missouri, the Paseo with its formal schemes of planting, the playgrounds dotting the city, and the smaller parks, all are pleasant surprises in a trip over the system. Swope Park a large part of which is still undeveloped, has wonderful opportunities, and already has a very fine shelter house, numerous lakes and playgrounds and a well-stocked zoo.

History of Development

The first steps in the development were taken in 1892, when the first Board of Park Commissioners, consisting of five members, was officially appointed. These men, all of high integrity and enthusiastic for city betterment, began a vigorous campaign to arouse public sentiment and to form a stable organization.

There being no specific tax for park purposes and no well-defined executive powers vested in the board, the progress of the work was somewhat retarded. Nevertheless, a general plan under the direction of one of the country's most competent landscape architects, was then evolved and signs of life were soon apparent.

The phenomenal increase of population and a growing public sentiment in favor of the plan resulted in a clamor for special legislation. In 1908 an article was inserted in the city charter reducing the

KANSAS CITY PARK SYSTEM.
West Pennway, Looking Northeast. Sarco Asphalt Macadam in Foreground. Bermudez Asphalt Macadam in Background Beyond Street Intersection.

KANSAS CITY PARK SYSTEM.

Tenth Street and West Terrace.

Before Improvement. After Improvement.

Cliff Drive.

Before Improvement. After Improvement.

number of commissioners to three, and defining the powers and jurisdiction of the board. This article provided for the acquisition of property by assessment and fixed a tax rate for general improvements and maintenance. The city was divided into park districts and internal improvements are assessed against the several districts for the improvement made within its boundaries.

The Acquisition of Property

The Board of Commissioners desiring to obtain certain lands for establishing parks, for opening and widening streets or constructing boulevards, makes its recommendation to the city council, which in turn passes an ordinance to acquire the necessary property, prescribes the method of assessment and the several zones benefited by said improvement.

A certified copy of the ordinance is filed with the clerk of the Circuit Court, who immediately fixes a time and place for empaneling a jury to award damages and benefits and to make necessary assessments to pay for property taken. This jury consists of six men, except in cases where the property to be acquired is owned by incorporated companies. All such corporations are entitled, upon request, to a common law jury. This jury, after due deliberation and due consideration of details, renders its verdict, which, if regular, is confirmed and the property is taken. The Circuit Court verdict is final, unless some irregularity is proven.

Park certificates or bonds may be issued in the ordinary manner. Much litigation is thus avoided, and the board is enabled to proceed unhampered by unscrupulous real estate agents who inflate values.

Organization

The agent largely responsible for the general appearance and the excellence of construction is the efficient, well-disciplined organization which has grown up under the supervision of the board.

The landscape architect who acts in a consulting and advisory capacity has worked out the detailed plan of the sys-

tem and has personally supervised the development since the inception of the plan. The work has thus been prosecuted along the broad lines necessary, and the numerous mistakes in policy and architecture, so noticeable in private work, are absent.

The superintendent, who is the executive officer of the board, directs the operations in the office and in the field, thru the heads of the various departments, among which are the clerical, engineering, construction, maintenance, operating and playground.

The secretary, assisted by accountants, stenographers and clerks, assumes responsibility for the accounting, records, cost-keeping, and all general clerical business. Special care is used in the distribution of labor and material expenses in all construction and maintenance. This affords excellent opportunity for intelligent study as to economical management.

The engineer of construction has supervision of work done under private contract, which naturally requires a corps of competent inspectors. These inspectors are young engineers or men who have had experience in engineering or contracting.

Thru this department the superintendent has been attempting to determine experimentally, from the standpoint of economy and efficiency, the roadway best adapted for boulevard traffic. The large local deposit of limestone has naturally resulted in the predominance of the macadam type of construction. The park department has about one million square yards of macadam pavement and one hundred thousand square yards of sheet asphalt. In this experimental construction various sizes and depths of stone have been used and numerous binding materials with various kinds of screenings in finishing.

The following table shows some of the types in use:

	Bottom Course		Second Course		Third Course		Finish	
	Size	Depth	Size	Depth	Size	Depth	Binder	Gals. Per Sq. Yd.
	in.	in.	in.	in.	in.	in.		
A	3 x6	6	2½x3½	4	.....	..	Road Oil	½
B	2½x3½	6	1½x2½	4	1x2½	2	Tarvia	2
C	2½x3½	6	1½x2½	4	1x2½	2	Sarco	2
D	2½x3½	6	1½x2½	4	1x2½	2	Texaco	2
							Bermudez	
							Pioneer	
E	2½x3½	7	1½x2½	5	.....	..	Oil—92 sp. g.	1½
							Oil—94 sp. g.	½

Two of these types are worthy of especial note, the water-bound macadam with the oiled surface and the asphalt macadam.

In the former the bottom course is usually six inches in depth and consists either of hand-broken stone up to six inches in greatest dimension, or a crushed stone 2 inches to 3½ inches. The second course is usually about four inches in depth, and in size varies from 1½ to 3 inches. This course is water-sealed by using a fine dust on the surface, usually about 1½ inches, flooding with a sprinkling wagon and rolling until a uniform closed surface is exposed. This is broomed and left for about forty-eight hours, ordinarily, to dry. Then an application of road oil with an asphalt base is used, about one-half gallon to the square yard and a layer of fine limestone or granite screenings cast on the surface to absorb excess oil. This road is not designed for heavy traffic, but under light traffic gives excellent service.

The late road construction requires a bottom course of hand-broken stone, ranging in size from 3 to 6 inches, compacted by rolling to a depth of 6 inches; and second course of 4 inches, running in size 2 inches to 3½ inches. This course is water-sealed and then a third course 2 inches in depth, of 1 to 2½-inch stone is applied. This course is treated with an asphalt binder by the penetration method, 1½ gallons first applied, covered with Joplin grit, rolled, and then a paint coat of one-half gallon applied and the final coat of grit, and the surface thoroughly rolled. This road is adapted to all kinds of traffic and will undoubtedly be widely used.

The department has several large operating plants, which are equipped with spacious wood shops, paint shops, machine and repair shops, and owns much road building machinery, such as rollers,

melting kettles, distributers, rock crushers, etc.

The assistant superintendent has charge of all construction work completed with the park labor and equipment. His work is directed thru district foremen who have certain boulevard mileage to maintain. Road repair, road oiling, general maintenance of parks, bath houses, playgrounds and operating plants naturally belong to this department.

The public bath house and the outdoor swimming pool are growing in favor and are used by thousands every year. The bath house in the congested or tenement district has proven its usefulness, and other houses are being planned.

A small engineering corps is maintained to do preliminary work and make final location. A small office force of draftsmen under the chief works up notes and maps and prepares estimates.

In 1910 a lady was appointed as supervisor of playgrounds and under her intelligent direction the playground has become a training school. Directors who have had experience in physical culture, kindergarten or playground work are employed on the various grounds and a regular daily program of instruction is followed. The proper use of playground apparatus, fold dancing, basket weaving, story-telling and various games adopted to the playground are features of this system.

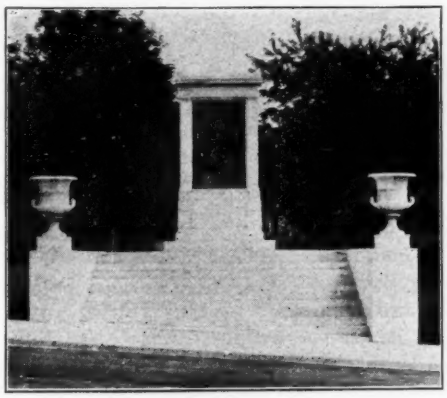
A close study is made of the individual and his home environment, and an effort made to teach habits of honesty and cleanliness. Clubs are formed at each playground and meetings are held during the winter months. Every effort is made to keep the children off the streets and to popularize the playground centers.

The Juvenile Court record shows that a large percentage of the children are kept off the streets and that there has been a great decrease in juvenile crime since the present recreation centers have been established.

Kansas City has kept pace with the progressive American city in creating a municipal civil service commission which fills all formerly appointive positions by competitive examinations.

The "merit system" has superseded the old "spoils" plan of distributing patronage and has eliminated much incompetency from all city departments.

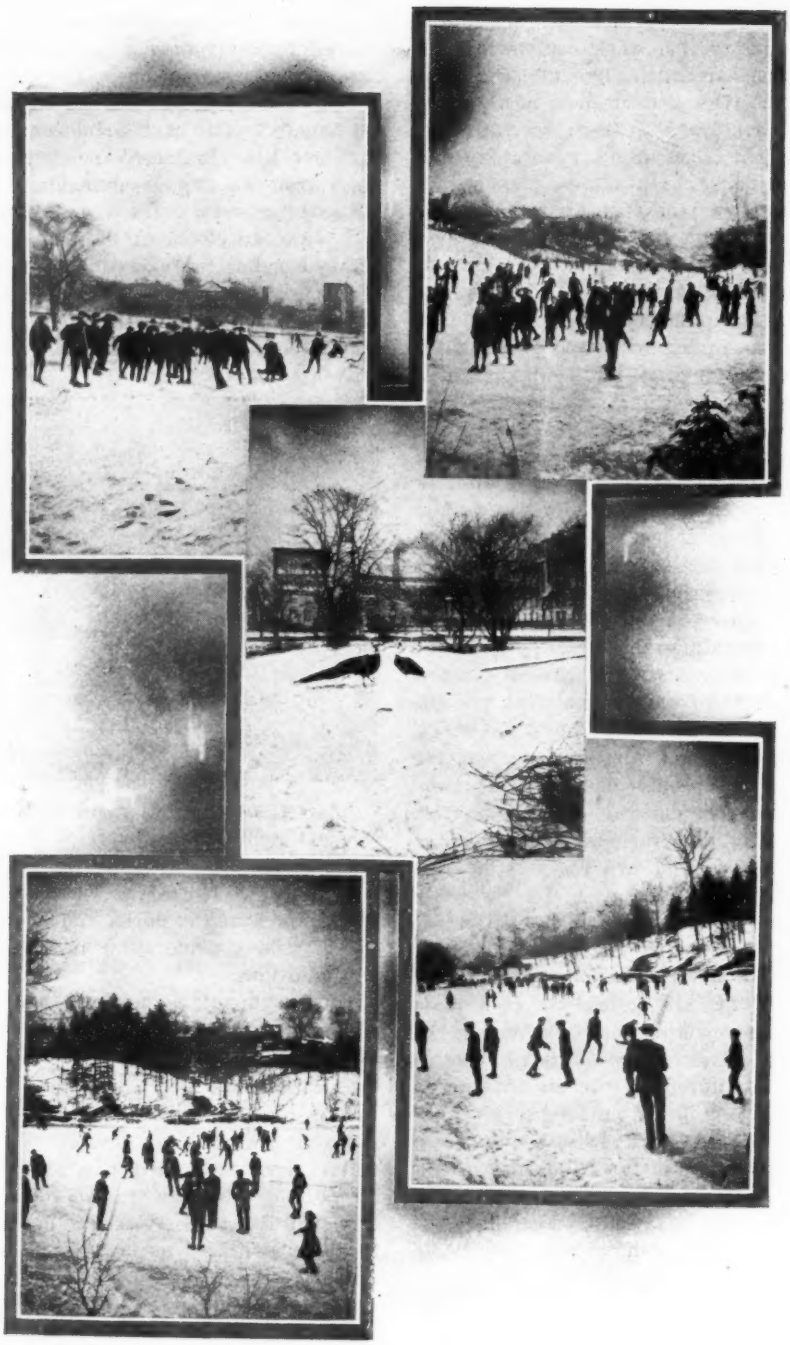
The interesting feature in the Kansas City park development is that it is on broad, sensible, natural lines, and wherever it has extended property values have increased. This fact is so generally recognized now that the parks and boulevards are of first consideration in laying out new additions.



THE KANSAS CITY PARK SYSTEM.
Memorial to President Meyer of First Park Board.

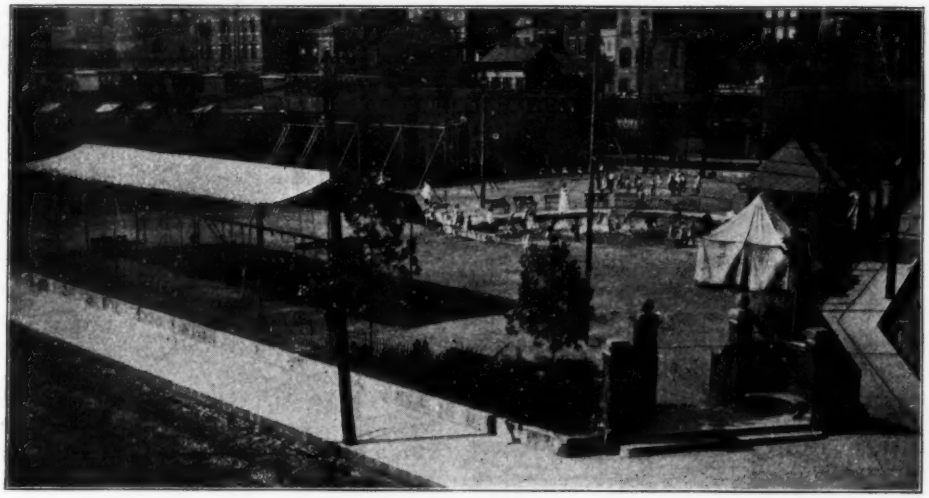
Thus as the city expands the boulevards and parks will occupy a prominent place in each development and there will be an unconscious growth.

With ten millions well spent and more millions awaiting to develop the little valley of the Blue River, a small tributary of the Missouri, we can readily predict that this park system is destined to become recognized as one of the best in the world.



CINCINNATI'S PLAYGROUNDS.
Skating on Park Ponds and Lakes.

CINCINNATI'S PLAYGROUNDS.



CINCINNATI'S PLAYGOUNDS.
Hanna Park Playground.

NEARLY all of the playgrounds of the city of Cincinnati, Ohio, have been developed within the past four years, but their extension has been rapid within that time and in 1912 there were nine children's playgrounds in operation under play instructors, in addition to several ball fields under less constant and detailed supervision. There are several new playgrounds, the sites of which have been purchased and the improvement of which is now in progress. All of these playgrounds are in charge of the Board of Park Commissioners and without connection with school buildings, and most of them are in separate locations, but few being located on or adjacent to parks, large or small. There are now twenty-two of these sites, thus providing quite generously for the children when the improvement of all of them is completed.

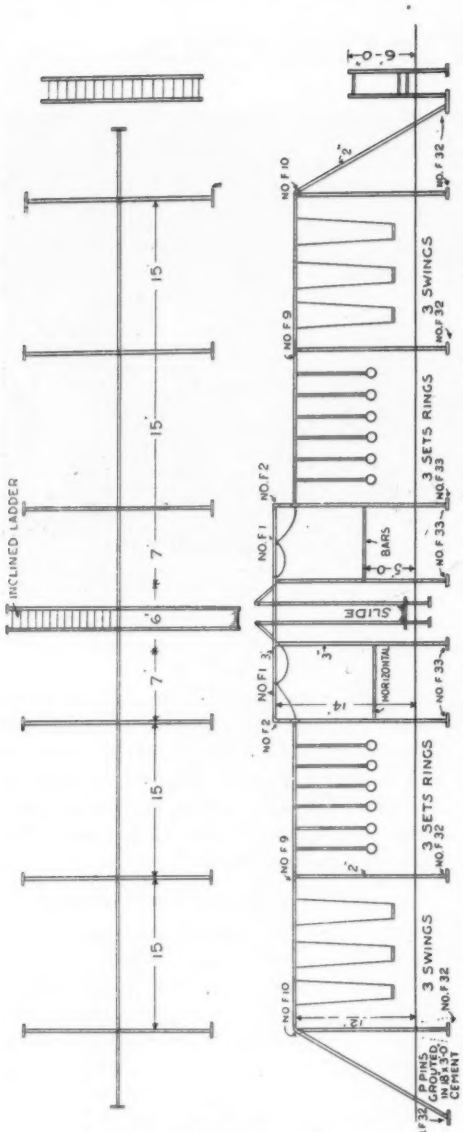
One-Third of Park Money Invested

During 1911 and 1912 the proceeds of a million-dollar bond issue have been available for park and playground purposes, and $963,241.75 have been spent, and practically 25 per cent. of the amount has been spent in the acquisition and improvement of playground properties for the small children, and an additional 10 per cent. has been spent for athletic grounds for the larger children and young men and women, making 35 per cent. for such active recreation purposes as compared with 65 per cent. for park purposes proper.

Value of Investment Demonstrated

Some idea of the cost of the property required for playgrounds may be gained from the report that the 7 properties bought during the past two years cost from $3,300 to $64,700, averaging a trifle less than $25,000 each. Sinton Park, which is located in a downtown district, has 2.33 acres area and the land alone cost $255,865, according to the report of 1908. The total cost of this park was more than $300,000. But it had 125,155 patrons during the season of 1912, and according to the probation officer, has reduced juvenile delinquency 67 per cent. in its neighborhood. Its value as an investment is fully demonstrated.

Nearly all the playgrounds and a few of the athletic fields are located in the congested districts, where they are most needed. It is the opinion of the director of playgrounds that one should be located for each 20,000 of population in



CINCINNATI'S PLAYGROUNDS.
I. Plan and Elevation of Standard Set of Apparatus.

such manner that it can be reached by five minutes walk from any point in the district. This can be done in the congested districts and can be approximated in any fully settled area.

Playground Equipment

The improvement on a playground consists of grading, placing a surface on the play areas, some simple apparatus, a wading pool and a building having dressing rooms for boys and girls, toilet rooms for each, a care-taker's room and porticos or spaces with awnings over them. If skating or sliding space is available there is also a room for a heating plant that the building may be used the year round.

The preparation of the surface of the playground is a problem which must escape on the one side the hardness which seems to be necessary for durability, and the brevity of life on the other side, which accompanies the elasticity of the ideal surface from the children's point of view. Cincinnati's experience has led to the recommendation of the following specification:

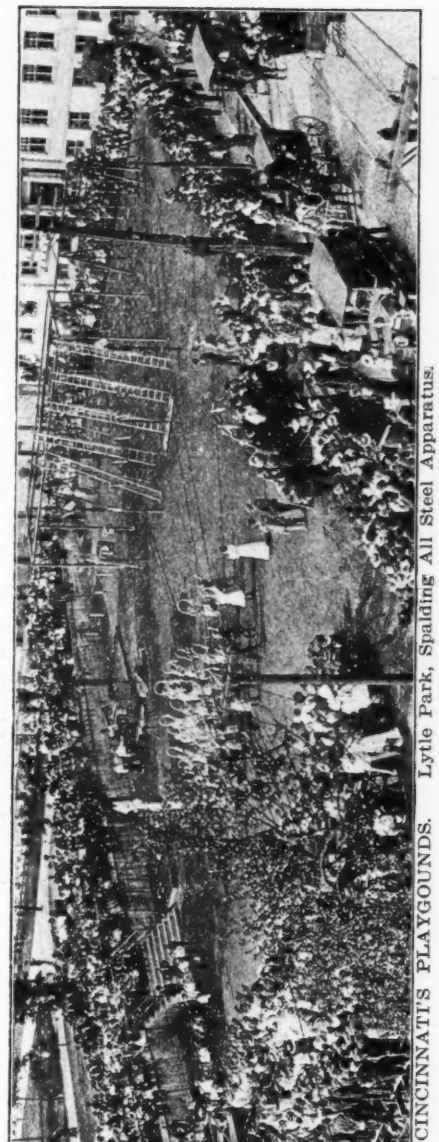
"Three to four inches of coarse cinders, well packed and rolled, covered with one to two inches of screen cinders mixed with equal parts of good clay, dampened and well rolled, will make an ideal play surface for athletic fields, running track, tennis courts or any other part of the play field. Such a mixture packs well, is springy, does not get dusty in dry weather, and can be played on in the rain."

Cinders mixed with tarvia have been used on some grounds with reasonable success. This surface is rather expensive, costing about 25 cents a square yard, including all material and labor, but not including the grading. It is reported that the surface is rather hard, the softening of the tar in hot weather not making the surface elastic and having a tendency to expose the corners of the particles of cinder.

Oiling the surface has not proven satisfactory, the principal complaint being that the children's clothes become very dirty and cannot be washed clean.

Standard Play Apparatus

The equipment of playgrounds for small children should be as simple as possible. The accompanying drawings show the standard adopted for Cincinnati. It is modified to suit the area available and the number of children to be served. The stand shown will cost in place from $480. to $550 if constructed according to the Cincinnati system. The fittings are purchased from the manu-



CINCINNATI'S PLAYGOUNDS. Lytle Park, Spalding All Steel Apparatus.

facturers; the piping for the frames is purchased in the city, cut to fit and made ready to set up; the concrete foundations are laid and the apparatus is put up by day labor. A concrete block six feet wide is recommended for location under each section of the frame, the place of greatest wear being the strip of this width under the swings and rings.

Buildings

The usual building of three rooms with two porticos, including all plumbing, glazing, plastering, painting, etc., the wading pool and cement paving, costs about $7,200, with extremes of $6,500 and $10,000. Under the porticos are located the sand-boxes and swings for the babies and the benches for their mothers. The standard equipment is 6 canvas hammocks and 6 swings.

Wading Pools

After trials of several forms of wading pool, when 16 inches was proved to be too little depth, and a pool sloping from zero to the maximum was found to have much useless area, a standard has been reached which has a depth of water around the sides of 16 to 19 inches and a depth in the center of 24 inches.

The playground director thinks that the wading pool should be kept for the use of the small children, and that each playground should be provided with a swimming pool for the larger children, who now make a failure in trying to use the wading pool for swimming. He refers to one in Potomac park in Washington, D. C., as being successful. It is made in two independent divisions which can be used separately or both at the same time, one having 3 feet of water and the other 5 feet as maximum depth. The pools are emptied and cleaned daily and a constant stream is kept running thru them, so that the water is changed constantly during the day.

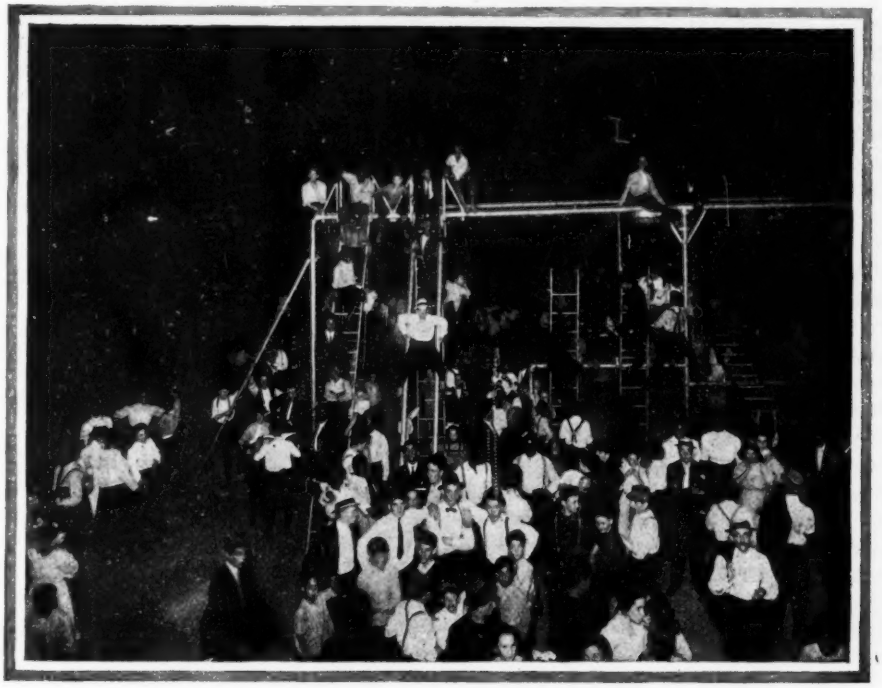
Play Instructors

The great problem of the playground is that of instruction. Children, especially in the congested districts, must be taught how to play, and they must have constant and sympathetic supervi-

CINCINNATI'S PLAYGROUNDS.
II. Playground Apparatus in Operation.

sion to keep them within the lines of proper conduct and to improve their mental and moral conditions. There are but few good instructors, and the attempts which have been made to teach the instructors have not yet produced a sufficient supply under the conditions of employment which obtain.

The playgrounds are regularly open but five or six months of the year, and there is nothing to take the time of the instructors during the remainder of the year. The consequence is that their ranks must be recruited almost wholly anew each year from those who are students in schools during the winter or can find winter employment, and are ready to take the brief and rather poorly paid positions during the summer. It is evident that the major part of the instructors are not properly equipped for their work and must be instructed anew each year. The playgrounds director each year recommends a spring school of instruction in which he can give at least a little idea of the problems which will arise and the methods of solving them, the instructors for the summer to be selected from the attendants at this school. There are a few volunteer instructors who can be depended upon for good work, but as a class they are not considered available. The number of trained directors is increasing each year, but fills a very small part of the demand. When indoor play spaces are provided for the winter season and the work can be continued throughout the year, the supply will be more constant and conditions will improve materially.



CINCINNATI'S PLAYGROUNDS.
III. The Apparatus in Sinton Playground in Use at Night.

Making allowance for the 8-hour day, where necessary, the nine playgrounds in Cincinnati in 1912 employed 16 directors and helpers at a total cost of about $4,000 for the season. Counting two directors, two helpers and a caretaker, a playground costs about $75 a week to operate during the season. Directors are paid $70 to $80 a month if men, $50 to $60 if women. Helpers are paid about $10 a month less respectively.

The grounds are not yet old enough to

give definite information regarding cost of repairs. The playground director estimates the repairs on the standard set of apparatus shown in the drawings at $5 to $25 a year according to the care taken of it and the roughness of usage.

Popularity Produces Large Attendance.

The attendance at the nine playgrounds open during the season of 1912 aggregated 673,131 children. The playground in Inwood park had 155,171 visitors, being in a rather congested residence district, and Woodward park, which is in an outlying district, had 17,252 visitors. In 1911 the attendance was 435,329, but nearly all of the difference between 1911 and 1912 is accounted for by the attendance, 212,863, in the three new playgrounds opened in 1912.

Local Aids

The mothers in several localities organized clubs to assist the play directors in their work, and by lawn fetes arranged in connection with the Fleischmann free band concerts increased the attendance, aroused public sentiment in favor of parks and playgrounds and raised funds to improve the sanitary and aesthetic conditions of the playgrounds, and in one instance to take the children on an outing to one of the new large parks. Sane Fourth of July celebrations were quite a feature, improving conditions and stimulating patriotic expression.

A daily program of play-activities and recreations was established, which was followed as closely as possible. Discipline was good and the work was conducted with spirit and enthusiasm. The difficulties met were mainly with older children whose wants are not provided for, and they are often guilty of disorderly conduct in the neighborhood. Playground ball games provided for some of the boys were not an entire success, perhaps because they were but a makeshift.

The People Approve

Cincinnati is proceeding in a very orderly and careful way in the development of its playground system, and as a consequence is gaining the constantly increasing confidence of the people. As the needs of the system are shown the money is provided for filling them, both by votes for bond issues and by private donations, some of which are worth hundreds of thousands. In anticipation of the exhaustion of the million-dollar park fund mentioned, an additional $750,000 has been voted. Many taxpayers made sure that a considerable proportion of the proceeds of these bond issues would be expended for playgrounds before they would vote for them.

The accompanying pictures show playground activities and the apparatus in use. One of the photographs in Plate II shows a part of the standard set in active use, the boys' end.

Plate III shows the use of playground apparatus at night. Wherever lighting and other facilities will permit the apparatus is kept in use in the evening as well as in the daytime.

The photograph at the head of this article shows Hanna Playground, the gift to the Park Board of Miss Mary Hanna. It is bounded by McMicken avenue, Dunlap and Stark streets, and contains one acre. Its equipment is well shown by the photograph, and shows the simplicity and at the same time the adaptability of the equipment. Permanent roofs will ultimately take the place of the tent and awning. The buildings in most of the parks are larger than that seen in this one.

The writer wishes to acknowledge the courtesy and kindness in supplying him with information and photographs and in enabling him to inspect some of the playgrounds of C. H. Meeds, chief engineer of the board of park commissioners; William Hodgkinson, secretary, and N. C. Seuss, director of playgrounds.

ORNAMENTAL LIGHTS OF BILLINGS, MONT.

By John N. Edy, Asst. City Engineer.

PRIOR to the 1911 session of the legislature there was no law in Montana covering the creation of special improvement districts for street lighting. Notwithstanding this fact, the city of Billings, thru the efforts of enterprising citizens, had installed 78 5-globe ornamental light posts, distributed thru a portion of the business district.

These lights, privately owned and maintained, proved to be an improvement of such value and attractiveness that the legislature was requested to pass a law providing for the creation of lighting districts. This statute was placed on the books in 1911, as stated, and Montana cities are now enabled to obtain a street lighting system in the same manner that street, sewer, sidewalk and other improvements are secured.

Proceeding in accordance with the provisions of the new law, Billings created "Lighting District No. 1," embracing all the territory known as the business district. Included within the boundaries of this district was all that property lighted by the privately-built system of 78 posts. And as the new contract provided for the installation of 116 additional posts, there are now in operation 194 5-globe ornamental lamp posts, replacing the old system of arc lights in the territory served.

The accompanying illustration indicates the effectiveness of the lighting system, while it also gives some idea of the post details and spacing. The post is of cast iron, 13 feet high, and weighs approximately 950 pounds. It sets on a concrete base next the curb and supports 4 40-watt and 1 60-watt electric lamps. All the globes are frosted, which accounts for the perfectly clear light and the lack of blur in the picture. These posts are spaced uniformly 95 feet apart along the streets and avenues, which are 80 feet in width. As the illustration shows, there are two posts at each block corner, each set 75 feet back from the property line; this brings 8 lights at each street intersection. There are 4 posts on each side of a 300-foot block.

ORNAMENTAL LIGHTING IN BILLINGS, MONT.

The contract price of installation complete was $80.00 per post, the Billings & Eastern Montana Power Co. being the con-

tractor. The maintenance expense, including current and breakage, is $5 per post per month, or a total of $970 for the entire district. Of the total cost of construction and maintenance, the city pays 25 per cent. and the improvement district pays 75 per cent.

Specifications

The following digest of the specifications is submitted:

The System—The system shall be multiple, the voltage 110. Not over 8 amperes to a circuit, nor 4 circuits to a cabinet box.

The Service—The service shall be two No. 8 rubber covered double braid wires placed in a suitable conduit leading from a height of 20 feet, in some convenient place located as the city engineer may direct. This conduit shall be laid into a weatherproof steel cabinet box, and made water-proof at its entrance. The wires shall be connected to a 25 ampere combination fuse and switch.

Circuits—The circuits shall consist of one duplex No. 10, 500-volt steel lead-covered cable, of approved type, fastened into a 10-ampere plug fuse in a cabinet box and then let out from same in an iron pipe to 24 inches below street or alley grade; except that where pavement or concrete walk exists the depth shall be determined by the city engineer.

After leaving the pipes the cable shall be laid as follows:

In unpaved streets; immediately outside the curb line in an 8-inch trench 24 inches below street grade.

In paved alleys; as near as possible to the building line of the alleys, in an 8-inch trench 24 inches below alley grade.

Across concrete alley crossings; in a trench chiseled in the concrete, two inches deep and wide, and covered when in place with a 1:2 portland cement mortar.

Across paved streets; in a trench chiseled in the concrete base of the pavement.

Parallel to paved streets or avenues; in a trench immediately inside the inside edge of the curb. Where the sidewalk extends to the curb, the trench shall be cut in the walk two inches deep and wide enough to admit the cable, which shall be covered with mortar as specified above. Where the walk does not extend to the curb, either on paved or unpaved streets or avenues, the cable shall be laid in a trench 6 inches wide and 12 inches below curb grade.

At the base of each post to be installed an 18-inch loop shall be left in the cable for the purpose of making connections with the wires in the post.

Posts—The posts shall be of cast iron, the weight, form and dimensions identical with those known as the Billings Standard, and shall be erected as set forth on the plan of the district.

The posts shall rest on a concrete foundation 2x2x2 feet, and shall be anchored to the same by means of 4¾x18-inch round anchor bolts embedded in the foundation. The top of the foundation shall be set to sidewalk grade.

The posts shall receive two coats of a mixture of pure linseed oil and lead, colored to match the posts now in place.

Post Fixtures—The posts shall be wired with 5 duplex, rubber covered, double braid No. 14 wire, connected to the socket and brought to the base of the post, and there connected with the cable and soldered and taped with rubber and friction.

There shall be 4 40-watt and 1 60-watt tungsten 110-volt lamps; and 4 12-inch and 1 16-inch alabaster globes, to each post. Globes to be firmly fastened with 4 cap-screws and tin collar. The sockets shall be 5 per post, Benco No. 4201, screwed to ⅜-inch nipples 4½ inches long so as to hold the light in the center of the globe.

Payments—Payment for work and material will be made on estimates of the city engineer, monthly, in warrants drawn on the funds of "Lighting District No. 1."

CREOSOTED BLOCK PAVING IN CHICAGO.

By John Ericson, Chief City Engineer, Chicago, Ill.

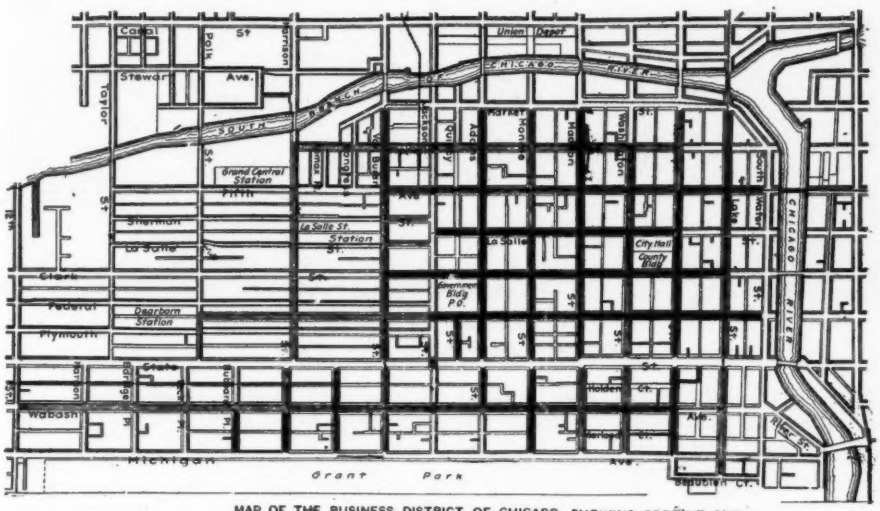
I RECENTLY made an examination of the method of treating wood paving blocks and the form of specifications under which creosoted block pavements are constructed in Chicago, to determine whether the treatment of the blocks is proper and sufficient.

That portion of our revised specifications referring to the preservative, as well as the manner of treating the blocks, reads as follows:

"Oil.—The oil shall be pure coal tar product, free from any adulteration. It must not contain any petroleum oil or any wholly from coal tar. The specific gravity at 25 degrees C. shall not be less than 1.08 nor more than 1.12."

"The oil shall be subject to a distilling test as follows:

"The apparatus for distilling the creosote must consist of a stoppered glass retort, having a capacity, as nearly as can be obtained, of eight (8) ounces up to the bend of the neck, when the bottom of the retort and the mouth of the off-take are in the same plane. The bulb of the thermometer shall be placed one-half (½) inch above the liquid in the retort at the



MAP OF THE BUSINESS DISTRICT OF CHICAGO, SHOWING PRESENT AND PROPOSED WOOD-BLOCK PAVING.

CREOSOTED BLOCK PAVING IN CHICAGO.
Showing Present and Proposed Block Paving in Business District.

product obtained from petroleum, and shall contain not more than five (5) per cent. of matter insoluble in hot benzol and chloroform. No oil obtained wholly or in part from water gas tar or oil tar will be accepted. The specific gravity of the oil shall not be less than one and ten-hundredths (1.10) or more than one and thirteen-hundredths (1.13) at twenty-five (25) degrees Centigrade."

The present specification for oil in Chicago reads as follows:

"The oil shall be a distillate obtained beginning of the distillation, and this portion must be maintained throughout the operation. The condensing tube shall be attached to the retort by a tight cork joint. The distance between the thermometer and the end of the condensing tube shall be twenty-two (22) inches, and during the process of the distillation the tube may be heated to prevent the congealing of the distillates. The bulb of the retort and at least two (2) inches of the neck must be covered with a shield of heavy asbestos paper during the entire

process of distillation, so as to prevent heat radiation, and between the bottom of the retort and the flame of the lamp or burner two (2) sheets of wire gauze, each twenty (20) mesh fine and at least six (6) inches square, must be placed. The flame must be protected against air currents.

"The distillation shall be continuous and uniform, the heat being applied gradually. It shall be at a rate of approximately one (1) drop per second, and shall take from thirty (30) to forty (40) minutes after the first drop of distillate passes into the receiving vessel. The distillate shall be collected in weighed bottles and all percentages determined by weight in comparison with dry oil. When one hundred (100) grams of the oil are placed in the retort and subjected to the above test, the amount of distillate should not exceed the following:

Up to 150 degrees Centigrade, 2 per cent.
Up to 210 degrees Centigrade, 10 per cent.
Up to 235 degrees Centigrade, 20 per cent.
Up to 315 degrees Centrigrade, 40 per cent.

These specifications, with a requirement that from 16 to 20 pounds of oil be injected in each cubic foot of wood, have since been in use for creosoted wooden block pavements for Chicago.

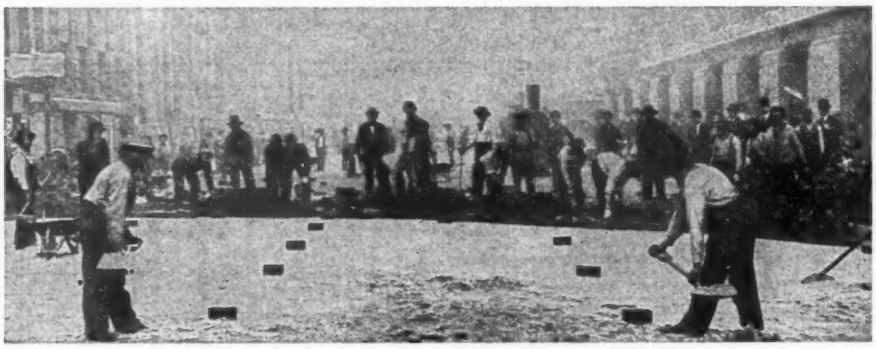
Method of Treating Blocks

I have not visited any plants to determine as to whether the method of treating the blocks is done in conformity with the above specifications, but as the Board of Local Improvements of Chicago have inspectors at the plants where blocks used for pavements in Chicago are treated, it has been accepted as a fact that the specifications have been complied with in this respect.

Proper Treatment of Blocks

To determine the proper treatment of wooden blocks for paving purposes is a problem not yet satisfactorily solved and which requires careful investigation and experiments.

The principal purpose of treating wooden blocks used for pavements with creosote or other preservatives is to prevent decay of the blocks, and also to prevent swelling or expansion of same by excluding moisture, and for that purpose waterproofing materials are sometimes added to the preservative.



CREOSOTED BLOCK PAVING IN CHICAGO.
Preparing the Sand Cushion Course.

Our knowledge of the effect of the preservatives on the lasting qualities of wood is so far based rather on experience than on any exact scientific principles.

Experience has proved that wood properly treated with creosote—a distilled product of coal tar—will resist decay many years longer than the same wood untreated.

Wooden pavements treated with from five to ten pounds of distilled creosote oil per cubic foot have been in successful operation in England and the continent of Europe for many years; in other words, such treatment has been sufficient to preserve the blocks from decay, and have given little or no trouble from other causes. The exact qualities of kreodone

oil are not known to me, but it is stated to have been a distilled creosote oil, with a small proportion of some heavy waterproofing substance dissolved therein.

I have had prepared a table containing pertinent information in regard to all creosoted block pavements laid in Chicago.

The information contained in this table has been obtained from records of the Board of Local Improvements, from contractors who have kept their pavements in repair under reserve, and from personal observations and investigations made by myself and my assistants.

As stated, wood blocks properly treated with creosote oil will not decay for many years. Whether the heavy tar mixed oil called for as the preservative by the before mentioned specifications will give any better results than the lighter oil previously used is a matter of serious question, and that can be definitely determined only by years of service.

CREOSOTED BLOCK PAVING IN CHICAGO.
Laying the Wood Blocks in Place.

A wood pavement has a certain length of mechanical life, depending on the traffic to which it is exposed. If the blocks are preserved from incipient decay an equal length of time, that seems to be all that could be required.

Communication with Mr. McGarvey Kline, director of the Forest Products Laboratory of the United States Forest Service, at Madison, Wis., was entered into. He and his assistants, Mr. Howard Weis, Mr. Winslow and Mr. Bond, are much interested in this subject.

This is a scientific investigation by experts, actuated simply by a desire to get at the truth. This investigation is now well under way, but will of necessity take some time to complete. I have secured from these experts a specification for the genuine coal tar creosote of high quality, and this specification I have already mentioned.

I have confidence in the value of blocks treated in accordance with this specification, because it is in line with the best experience in wood preservatives, and I have personal knowledge of pavements treated in accordance with a specification quite similar, which have been in use for a number of years, with excellent results.

This does not necessarily mean a condemnation of the heavy oil above referred to for paving purposes. As a matter of fact, the traffic conditions of each street to be paved should be specially considered and specifications prepared that will meet the requirements of each particular case.

From my investigations and inquiries I am of the opinion that pavements laid with block treated under the old forms of specifications or with creosote of a specific gravity of 1.08 or 1.09 are preferable to those treated with the heavy oil later specified, at least for traffic streets in the city of Chicago, where traffic soon makes the blocks impervious to water;

That the "bleeding" is caused principally by the use and excessive quantity of this heavy tar oil in the preservation of the blocks, which is in some cases aggravated by improper provision for expansion;

That this "bleeding" can be largely avoided by the use of the lighter creosote oil as a preservative, and by the proper

selection and manner of placing the filler between the blocks;

That absorption of water and the consequent heaving of the paving can be avoided by laying the blocks in the pavement as soon as they are delivered on the work and by the provision of the proper expansion joints;

That no definite rule as regards the character of oil, manner or treatment, etc., can be adopted for all conditions of streets and traffic, but that different conditions require different treatment;

That if the lighter oils for preserving wood blocks for pavements are eventually found to be preferable to the heavier oils for all conditions, there can and will undoubtedly be an inducement to cause sufficient oil to be manufactured for this purpose at a reasonable price;

That fifteen pounds of oil per cubic foot of wood is generally sufficient to effectively preserve the wood for the length of time of its mechanical life and prevent absorption of water, and that it may be found that much less than fifteen pounds will do. This will vary with the traffic conditions.

Up to November 1, 1911, there had been laid on Chicago streets 439,466 square yards of creosoted wood block pavement and since January 1, 1912, contracts have been awarded for 111,790 square yards, some of which is completed and the balance is now in various stages of construction.

CONCRETE SEWER CONSTRUCTION IN LOUISVILLE.

By J. H. Kimball, Designing Engineer, Commissioners of Sewerage.

THE choice of a material to be used in a structure is a matter of the first importance, involving, as it does, such considerations as strength, endurance and cost.

Several years ago when concrete came into competition with brick masonry for sewer construction, its entire suitability was doubted by many engineers. Some who questioned the strength of concrete did not dare to use it as the sole material in the arch and depend upon it to support the full load over the sewer and, therefore, built a concrete invert with an arch partly or entirely of brick. Other engineers, having more confidence in the strength of concrete, but fearing the action of sewage on concrete, built sewers with a brick invert and concrete arch. As both the concrete invert and concrete arch proved to be satisfactory, concrete came into general use for the construction of the entire sewer barrel.

The Commissioners of Sewerage of Louisville are now completing its $4,000,000 system of sewers. In this system, which is very largely of trunk sewers, concrete has been the principal material used. Vitrified pipe was used in the smaller sizes, but the sewers from 23 in. to 15 ft. 6 in. in diameter were almost without exception built of plain or reinforced concrete. In a few instances vitrified pipe was used as a lining and in some instances vitrified street paving brick was used as a lining in the lower portion of the sewer when, on account of steep grades, very high velocities will be reached by the sewage. Ordinary brick have not been used at all in the construction of these sewers.

Reasons for Adopting Concrete

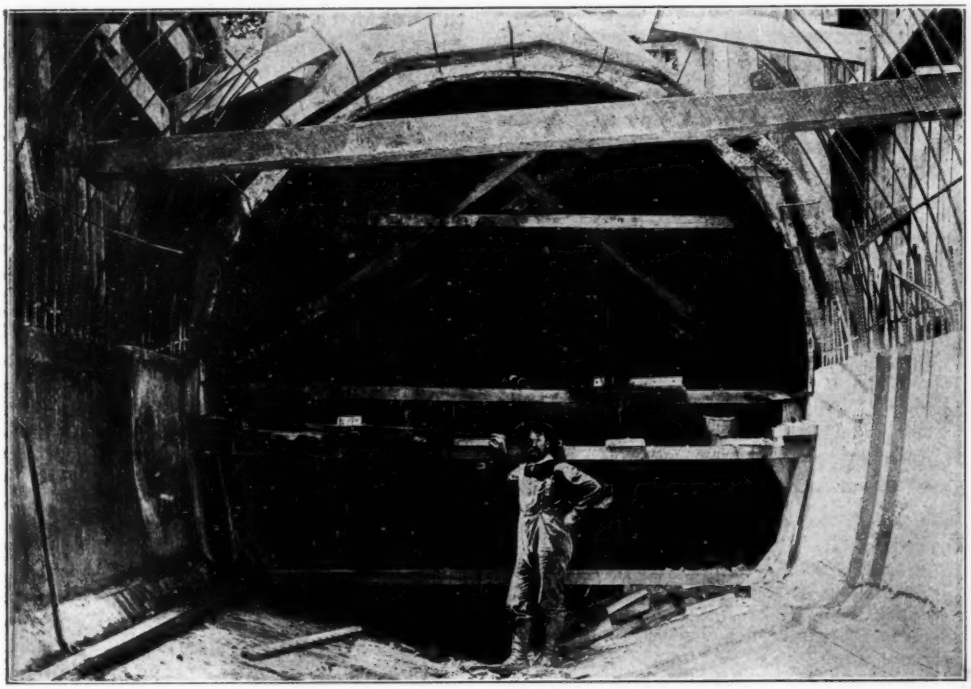
The choice of the best material for the sewer masonry was carefully considered previous to the commencement of construction, and the reasons for the adoption of concrete were set forth in the report of the commission for 1909-1910 as follows:

"Very careful consideration has been given to the selection of the kind of masonry to be used in the construction of the sewers and drains. The size of a sewer depends to some extent upon the smoothness of its interior surface and be-

cause of the smooth finish which can be obtained with the use of concrete, this material is particularly favorable for this class of structures. A further argument in favor of the use of concrete is the fact that it is much less expensive per cubic yard than brick or stone masonry. It is also possible because of the practicability of building monolithic structures to vary the thickness of the walls in a way which cannot be done with brick or stone masonry because of the fixed dimensions of the blocks, and thus reduce slightly the wastes from many manufacturing establishments. As a result of these investigations it was decided that it was perfectly safe to use concrete in the construction of the sewer system and its use was, therefore, adopted."

Brick Sewer Larger for Same Capacity

The necessary increase in size of a brick sewer above a concrete sewer, due to its larger degree of roughness, in order to have a sewer of equal capacity, is often as much as 15 per cent. On account of



CONCRETE SEWERS IN LOUISVILLE, KY.
Reinforced Concrete Outlet Sewer, Showing Reinforcement and Forms Used in Construction.

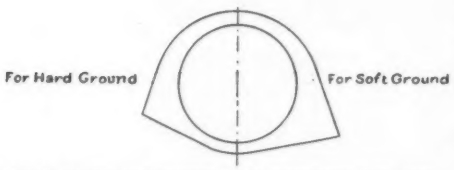
thickness where not required and increase it where needed. In this way an additional reduction in expense is effected by reducing the quantity of masonry required per linear foot.

The only serious danger in the use of concrete is that it may be affected by acid in the sewage. Fresh sewage is normally alkaline and practically the only source of acid is the waste liquors from manufacturing establishments. A careful examination was made of the sewage in various sewers about the city and of such an increase the cost of both sewer masonry and excavation is necessarily increased, and in crowded streets in which it is often difficult to find sufficient space for an additional structure it is imperative to select the smallest possible size.

Erosion of Concrete

A very eminent authority stated a number of years ago of concrete, "It is superior to brick masonry in strength, hardness and durability." Concrete sewers after twenty years of wear have shown

no appreciable deterioration. Mr. A. P. Davis, chief engineer of the U. S. Reclamation Service, in an article on the "Safe Velocities of Water on Concrete," has given some very interesting cases of the power of concrete to resist erosion. In two conduits having at times velocities of above 20 and 40 ft. per sec., respectively, no damage to the concrete was perceptible. A culvert thru a dam having a flow of water thru it of a velocity between 75 and 90 ft. per sec. for six months, was "absolutely uninjured" by the water. In the flow over the surface of a dam in which the water reaches a maximum velocity of over 70 ft. per sec., there was no actual damage to the dam but a slight wear was visible evidently due to presence in the water of large quantities of sand flowing over the dam. Mr. Davis, however, speaks of one instance in which a stream flowing in a tunnel at a high velocity was broken up by a change in the cross-section of the tunnel and the presence of four iron gates. Owing to these conditions the stream became turbulent and the resulting impact of the water was



CONCRETE SEWERS IN LOUISVILLE, KY.
Section Showing Modifications for Construction in Hard and Soft Ground.

destructive to the tunnel lining, composed of concrete faced with steel. Mr. Davis concluded from his observations:

1. "That where clear water can be made to glide over concrete without disturbing its velocity or abruptly changing its direction, there is no practical limit to the velocities that can be permitted without harm."

2. "That concrete which is subjected to the impact of water under high velocity is rapidly eroded and that under such conditions the velocities must be carefully limited."

Such tremendous velocities as he cited as having caused damage would be difficult to find in sewer practice.

The wear in sewers is due to the erosion by sharp, hard sand or detritus from street paving. Brick sewers in streets on steep grades paved with trap rock macadam have sometimes shown considerable wear while in others on which the macadam was a comparatively soft limestone no wear was perceptible.

The superior hardness and strength of concrete makes possible a less quantity of masonry.

Advantages of Concrete in Construction

As concrete is placed in a fluid condition it can be made of any thickness required by strength and may be molded into any form desired, as in the junction of two sewers where the edges between intersecting surfaces form very intricate shapes.

Some of the important advantages of concrete over brick are developed in practical construction. Although skilled labor is required for the construction of brick masonry, every engineer knows the difficulty of obtaining the joints completely filled with mortar. Without this the joint becomes the weakest, whereas it might be the strongest point of the masonry. tI is not uncommon to find brick sewers with an occasional brick fallen out from the arch.

In the construction of circular brick sewers, unless the ground in which the sewer is being built is exceptionally hard, the trench is necessarily dug to an approximately rectangular shaped cross-section, the bottom being nearly flat. As the brick work is laid in the lower half of the sewer the excavated material is replaced in the trench to support the green masonry, and in order not to force the masonry out of place before the mortar has set, the material is placed so lightly that it cannot support the sides of the sewer. Tthe result is that when the weight of the earth is placed on the sewer the structure is ruptured to a greater or less degree. In Louisville the standard shape of the circular sewer is shown herewith in which the weight of the sewer and the backfilling above are borne by the natural undisturbed ground.

Concrete Sewer Has Less Seepage

Another and oftentimes a very import-

ant advantage in concrete is its comparative water-tightness. Concrete can be made practically impervious by the proper proportions of materials and by properly depositing it in place. For waterproof work a "wet mixture" of concrete should be used. Several waterproofing compounds for concrete are on the market, but for sewer construction it will seldom be necessary to use any more expensive material than hydrated lime or a very fine sand or clay. In Louisville a concrete sewer laid for about 2,500 feet in a water-bearing clay in the bank of a creek was made so water-tight by replacing 10 per cent. of the sand of the concrete by a like amount of fine molding sand that the leakage, if any at all, was insignificant. Brick masonry is water-tight only insofar as the mortar is water-tight and continuous, as ordinary bricks are porous and will allow a considerable amount of seepage through them.

Economy of Reinforced Concrete

Concrete through its capability of being united with steel may be used with great economy in the larger sizes. Reinforced concrete is particularly useful in sewers with a flat roof or arch. In addition to the advantage of being able to design a section in which tensile strains are expected by the use of steel reinforcement, this material may be utilized to render safer a sewer liable to be subjected to strains that cannot be determined in advance.

In Louisville, it was found that a saving in expense might be obtained in the use of steel reinforcement in all sizes above 5 feet in diameter and in several cases in smaller sizes. In the larger cases the thickness of concrete in the arch and sides was but a little more than one-half that which would have been necessary in an unreinforced structure.

With the exception of one contract in which reinforced pipe was used, all the concrete was monolithic. On this acaccount there were no joints. Steel forms were used in most of the largest sewers, but were not required. On a few contracts wooden forms with metal covering were used. All wooden forms were so finished as to have no irregularities or rough spots, and a very smooth finish was uniformly required. After the sewers had been in use for several months, a thin film of slimy growth developed. This growth is not of sufficient amount to have any appreciable effect on the flow in the sewer.

There have been no failures in the concrete sewers built, although cracks appeared in the masonry on the first sections built on a few of the contracts, due to the use of dry wood forms. These forms, absorbing water from the concrete, swelled, thereby cracking the concrete before it was set. Another source of trouble was found in cases in which trench sheeting was driven below the bottom of the sewer. This sheeting being pulled and the space occupied by it not being completely refilled, small cracks developed on account of the spreading of the sewer. These difficulties were soon discovered and easily corrected.

Reinforced Concrete Pipe

Invitations were occasionally given the contractor to bid on reinforced concrete pipe. With one exception, the bids on reinforced pipe were always higher than on the monolithic concrete. The specifications required a test loading according to the following table, and also a test for imperviousness.

Size.	Load'g per Length of 3 ft.	Size.	Load'g per Length of 3 ft.
24 ins.	6,000 lbs.	42 ins.	10,500
27 ins.	6,750 lbs.	48 ins.	12,500
30 ins.	7,500 lbs.	54 ins.	13,500
33 ins.	8,250 lbs.	60 ins.	15,000
36 ins.	9,000 lbs.	66 ins.	16,500
39 ins.	9,750 lbs.	72 ins.	18,000

Relative Economy Is Factor in Choice

The use of concrete may be less economical than the use of brick in localities in which materials for brick manufacture are readily accessible and the materials for concrete are difficult to obtain. In Louisville, concrete was found to be cheaper, and as it was considered much more suitable, its use was adopted. The experience of the commission with this material was uniformly satisfactory so that the conclusion formed previous to the construction seems to have been fully justified.

GRADE AND SURFACE REQUIRED ON ROADS.

THERE are so many variables that enter in to affect the draft of any vehicle, that it is difficult, in a test made under actual working conditions, to separate the effect of any one of them, and for the same reason it is not safe to put too much confidence in the results obtained from a limited number of tests, or to compare the results made by different persons under unlike conditions and at widely varying times.

Some of the variables that are sure to enter in are:

1. The team.
2. The driver.
3. Nature of surface.
4. Condition of the surface.
5. Grade.
6. Width of tire.
7. Diameter of wheel.
8. Design and condition of vehicle.
9. Magnitude of load.
10. Curves.
11. Slopes.

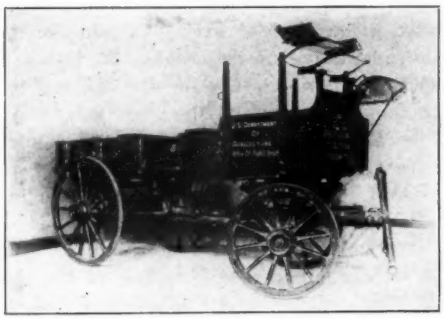
It has been found by the writer and by those with whom he has talked, that in any series of tests it is absolutely essential to select a team of horses or mules that are willing, and that have been trained to steady pulling and even starting, and to retain the same team thruout any series of tests. Furthermore, it is necessary to practice a constant deception on the team in this way; the run should overlap the distance tested by an appreciable amount at each end; that is, the team should be driven several rods past the designated point before any attempt in checking it is made. If this is not done, after the first few trips the team will begin to stop before the point is reached, and the momentum of the vehicle will enter in and will vitiate, to a great extent, the results obtained.

The tests conducted under the supervision of the writer, since 1908, have been run with a traction dynamometer wagon owned conjointly by the U. S. Office of Public Roads and the Engineering Experiment Station of the Kansas State Agricultural College. The dynamometer proper is suspended from the bed of a Studebaker truck about midway between the front and rear axles. The pull is transmitted by the tongue directly to the dynamometer, which pulls on the rear axle. The draft is measured by the compression of two carefully calibrated coil springs, and is transmitted thru gears to a brass point, which marks the record on sensitized paper operated by friction rolls, but over a flat platen.

The following cuts shows the arrangement of the dynamometer and also its method of attachment to the truck. The truck is provided with eight sets of wheels ranging from 1⅝-inch tires up to 6-inch tires.

Dynamometer Wagon.

The dynamometer was designed at the college in 1906, and has been in frequent use since that time. It was attached to the truck in 1908, and repeated calibrations have shown that the dynamometer registers very accurately.

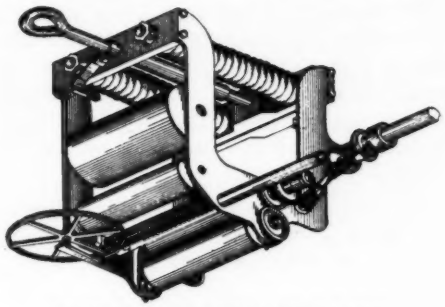


GRADE AND SURFACE ON ROADS.
Dynometer Wagon.

While some road materials maintain their characteristics under different conditions, others vary materially with weather and atmospheric changes. Deterioration is much more rapid with some forms of road surface than with others, and some materials, such as dirt, macadam, gravel, etc., are subject to occasional changes in conditions from which the harder materials are free. A pebble

½ inch in diameter may show an increase of 50 to 75 per cent. in the draft required at that particular point; or the wheel may strike it in such a way that no apparent change can be detected.

Of the other variables, some will become constants for any particlar stretch



GRADE AND SURFACE ROADS.
Dynometer Attachment.

of road; others, such as width of tire, may be governed in some instances; while still others, such as design of vehicle, can seldom be taken into consideration.

Grades.

Increasing the grade decreases the load that can be hauled, in each of three ways:

1. The required pull per ton is increased.

2. The possible pull of the horse is decreased by the effort required for the horse to raise his own weight thru the grade.

3. The effective pull of the horse is diminished by a change in the angle of the application of the pull.

There are no ways of overcoming the first two losses; the third, however, can be nearly if not entirely eliminated by a change in the methods of hitching. A comparison of the figures in the following table will show very clearly the decrease of effective work with the increase of grades. The first column shows the actual pounds of pull required to draw a gross load of 5270 lbs. over a dry, hard earth road, solid and well compacted, no dust, and using 1½-inch tires. These figures are from a test made at the Kansas State Agricultural College on August 12, 1912. The third column gives pounds pull required per ton as figured from values in the second column. The fourth column gives draft in pounds per ton as taken from results of tests on macadam roads. The fifth column shows possible pull of 2800-lb. team on the different grades. These figures assume that a team can exert a pull equal to one-third of its weight for a short time, on the level, and that on grades the tractive effort of the team decreases an amount equal to the grade resistance due to its weight, as calculated by the formula:

$$X = \frac{W}{3} - \frac{W}{100} G$$

Where W = weight of team
X = tractive effort of team
G = per cent. of grade.

TRACTIVE FORCE.

% Grade.	Dirt Road. 5270 lbs.	Per ton.	Macadam.	Possible pull of 2800-lb. team for a short period of time.
0	263	100	38	933
1	315.7	120	58	905
2	368.4	140	78	877
3	421.1	160	...	849
4	473.9	180	118	821
5	526.5	200	138	793
6	579.2	220	...	765
7	631.9	240	...	737
8	684.6	260	...	709
9	737.3	280	...	681
10	790	300	...	653

A comparison of these figures will show that the necessary pull on a 10 per cent. grade, over that on a level, is 200 per cent. for a dirt road, while the decrease in effective pull for any given team is nearly 30 per cent., and that for a dirt road any given team can pull on a 10 per cent. grade only 2/9 of the load that it can draw on the level.

In order to get some figures from recent practice, the writer, on September 12, 1912, had observations taken on four teams hauling brick a distance of practically two miles over five different kinds of road surfaces. These teams are used in delivering coal from the railroad to the Kansas State Agricultural College, and are accustomed to hauling heavy loads under all sorts of road conditions. The results obtained from these observations

are undoubtedly larger than can be secured by taking an average of a large number of teams selected at random. In the following tables are given the nature of the road surface, the weights of the loads and the teams, the length, grade, and condition of the road, the apparent effort exerted by the team, the number of rests made, and the theoretical draft that would be required as shown by the draft required for surfaces of that nature. From the draft required for the given load, and the weight of the team, was calculated the probable pull of the team in per cent. of its weight.

CINDER ROAD.

No.	Weights. Load.	Team.	No. of rests.	Theoretical draft required. Per ton.	Per load.	Probable pull of team in % of its weight.
1	8770	2580	1	92	403.5	32.63
2	8440	2600	1		388.3	31.16
3	8160	2620	1		375.4	29.80
4	7090	2670	1		316.2	25.40
Aver..	8115	2617.5			Aver..	29.75

Length—500 feet.
Grade—No grade.
Condition—Solid, but dusty in places. Rough where tires cut in.
Apparent effort of team—Heavy pull to start load. Heavy pull to keep load moving.

ASPHALTIC CONCRETE.

No.	Weights. Load.	Team.	No. of rests.	Theoretical draft required. Per ton.	Per load.	Probable pull of team in % of its weight.
1	8770	2580	0	40	175.4	23.80
2	8440	2600	0		168.8	22.70
3	8160	2620	0		163.2	21.80
4	7090	2670	0		141.6	18.60
Aver..	8115	2617.5			Aver..	21.70

Length—2760 feet.
Grade—1.5%.
Condition—Very good—in use one year.
Apparent effort of team—Fairly easy.

BRICK PAVEMENT.

No.	Weights. Load.	Team.	No. of rests.	Theoretical draft required. Per ton.	Per load.	Probable pull of team in % of its weight.
1	8770	2580	0	56	245.5	26.50
2	8440	2600	0		236.3	25.40
3	8160	2620	0		228.5	23.90
4	7090	2670	0		198.3	20.70
Aver..	8115	2617.5			Aver..	24.00

Length—5000 feet.
Grade—0.5%
Condition—Good—new.
Apparent effort of team—Medium.

DIRT ROAD.

No.	Weights. Load.	Team.	No. of rests.	Theoretical draft required. Per ton.	Per load.	Probable pull of team in % of its weight.
1	8770	2580	1	100	438.5	34.00
2	8440	2600	1		422	32.50
3	8160	2620	1		408	30.60
4	7090	2670	1		354	26.50
Aver..	8115	2617.5			Aver..	30.90

Length—1050 feet.
Grade—None.
Condition—Good—well compacted, dry, but not dusty. Surface smooth.
Apparent effort of team—Heavy.

MACADAM ROAD.

No.	Weights. Load.	Team.	No. of rests.	Theoretical draft required. Per ton.	Per load.	Probable pull of team in % of its weight.
1	8770	2580	3	150	658.8	42.50
2	8440	2600	3		633	40.60
3	8160	2620	3		612	38.90
4	7090	2670	..		531	33.00
Aver..	8115	2617.5			Aver..	38.75

Length—1500 feet.
Grade—5%.
Condition—Solid road; surface good condition.
Apparent effort of team—Heavy pull the entire length.

The results of these observations would indicate that a well-trained team can exert a pull of from 1/5 to ¼ of its weight thru a distance of practically one mile; a pull of from ¼ to slightly over 1/3 of its weight for a distance of 500 feet, and, on macadam, a pull of from 1/3 to nearly ½ of its weight up a 5 per cent. grade for a distance of 500 feet.

Therefore, in considering the permissible grade, in any given case, it is necessary to take into consideration the probable weight of load to be hauled, and the type of horse to be used; then the maximum permissible grade will be that which the team of horses can draw over that grade. This will be determined by figuring the time necessary to travel from the bottom to the top, and the possible force that the team can exert for that length of time.

Materials.

The figures given in the description of the effect of surface are taken from tests conducted under the supervision of the writer during the past few years; from those conducted by Professor H. J. Waters at the University of Missoui, some years ago, and from other sources, indiscriminately, when the indications were that sufficient tests had been made to give dependable results. Those conducted by the writer were made, in both dry and wet weather, on dirt roads of various kinds; on gravel, macadam, and oil roads; on vitrified paving brick, and on asphaltic concrete. Those made by Professor Waters include block pavements in good and in poor condition, fair macadam, best macadam, cobble stone, and various types of dirt roads. The other figures are for granite tramways, wood block, asphalt, and macadam.

Deductions drawn from the averages, obtained by combining these different tests, are not strictly accurate, as the tests were conducted under different conditions of driving, vehicle, etc., but as these varying conditions exist in practice, the writer has deemed it of interest to combine the tests and average the results. The following are the figures so obtained:

Surface.	Tractive force per ton.
Earth—packed and dry	100
Earth—dusty	106
Earth—muddy	190
Sand—loose	320
Gravel—good	51
Gravel—loose	147
Cinders—well packed	92
Oiled road—dry	61
Oiled road—wet	108
Macadam—very good	38
Macadam—average	46
Sheet asphalt	38
Asphaltic concrete	40
Vitrified brick—new	56
Wood block—good	33
Wood block—poor	42
Cobble stone	54
Granite tramway	27

Incidentally, tests cannot show the force with which a team can grip these different pavements, and, therefore, as will be discussed later, these figures must not be used without taking other variables into consideration.

The effects of temperatures and of moisture are shown very clearly in two tests made at Manhattan, Kansas, in July, 1912, on dry and on wet asphaltic concrete. During the test the atmospheric temperature increased from 82 degrees F. to 98 degrees F. On the dry surface the draft increased 28 per cent.; on the wet 17 per cent. It is very apparent that any consideration of asphaltic concrete for use in any particular place, that does not take account of the probable temperature, will, of necessity, be incomplete.

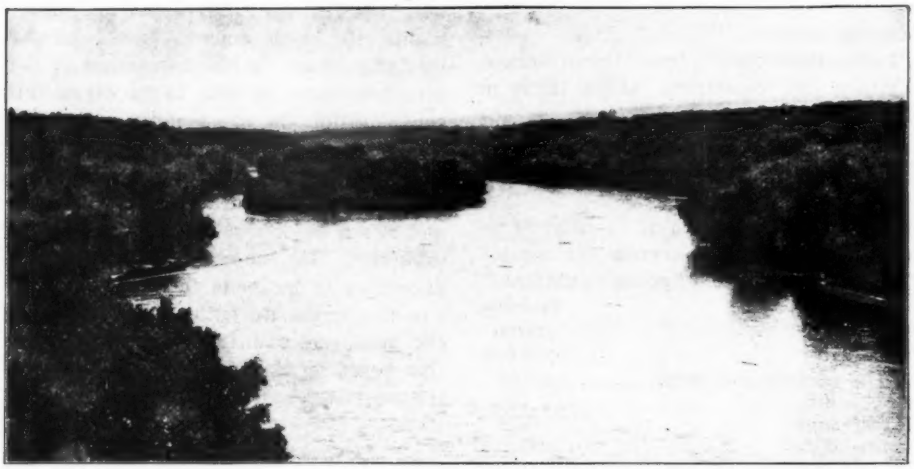
If the tractive force per ton was the only factor that entered in, in determining grades and materials, the solution of the problem would be comparatively simple, as with any given material and with known loads the maximum grade of any given length will of necessity be fixed; but, besides the difference in pulling power that exists among horses, and particularly when combined in teams of two or more, there is also to be taken into consideration the effect of the surface on the grip of the horse. This feature varies with any given substance according to conditions of temperature and moisture, and is not determinable to any degree of accuracy. The question of the relative allowance to be made for this feature is one that must lie with the judgment of the engineer, and the best judgment is that based on the observation of the paving materials under the various conditions.

In the opinion of the writer, the best pavement for steep grades, considering both security of footing and the tractive resistance, is either granite block or vitrified paving block with the spaces between the blocks filled with asphalt or pitch. The softer material in the crevices offers a grip for the calks of the shoe. In the case of cobble stone the effect of the uneven surface, while beneficial to the grip, is to increase the tractive force required, and seriously to increase chance of injury to the horse.

In New York City there are instances of grades of 12.17 per cent., 15.17 per cent., and 18.17 per cent. In Pittsburg grades of 17 per cent.; in Duluth of 12.2 per cent., and in Kansas City of 16.5 per cent.

THE MINNEAPOLIS PARK SYSTEM.

THE first tract of land dedicated for a public park in Minneapolis was Murphy Square, a little larger than an ordinary city block, given by Edward Murphy in 1857. In 1873 the donor secured an appropriation of $500.00 from the city council for the first tree planting and fencing, and made the improvements at his own expense, as the mayor refused to sign the warrant. In 1882 Hawthorne park, about one acre, was bought for about $13,000.00, nearly one-half contributed by citizens. Franklin Steele Square was donated the same year. The rejection of the project to secure Nicollet Island for a park, thru lack of sufficient votes, is most regrettable, as its acquisition now would be almost prohibitive and the loss seems irreparable.



THE MINNEAPOLIS PARK SYSTEM.
Mississippi Park from Government Dock and Dam No. 1.

Park Commissioners Appointed

In 1883 the board of park commissioners was created, with twelve commissioners, who, with the mayor, the chairman of the committee on public grounds and buildings, and the chairman of the committee on roads and bridges of the city council, constitute the board. It has control also of tree planting on city streets and power to assess the cost on benefited property.

From 1883 to 1906 the board acquired, thru purchase and donations, about 1,800 acres of park land, of which 462 acres were in water area, at a cost of $1,999,-550.55, the value of donations being estimated at $457,900.00. The improvements during the same period cost $1,039,199.27.

From 1906 to 1912 the park area has increased thru acquisitions and donations 1,875 acres, and the total area today is 3,685 acres, of which 1,287 acres are water areas. The cost of acquisition in this period has been $2,111,554.34, and the value of donations estimated at $254,-050.00. The cost of improvements for these six years has been a little over $600,000.00.

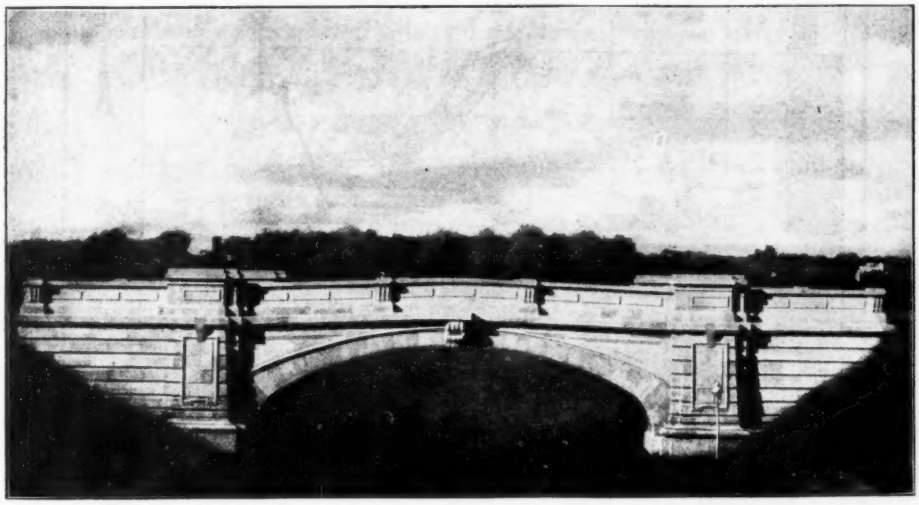
Cost of Park System

Altogether, the cost of park acquisitions has been $4,111,104.89, and of this amount $2,902,480.30 has been issued in park certificates of indebtedness, payable one-tenth each year from the special tax levied upon benefited property, and the balance paid from bond issues for the payment of land acquisitions, and from the general fund. The total value of land donations is placed at $701,950.00.

January, 1913.

The board has secured its land acquisitions at very reasonable prices, and in this connection great credit is due its present capable secretary, Mr. J. A. Ridgway, former commissioner, for his singularly efficient service, both during his term as commissioner and while secretary. The largest part of the land has been acquired during his connection with the board, and unquestionably he has saved the city thousands of dollars in its land transactions.

Improvements to January 1, 1912, have cost $1,643,800.65, and the value of donations and buildings estimated at $68,242.54. The inventory of parks and parkways, based on original cost of lands purchased and improvements made to January 1, 1912, and estimate of value of donated land, makes a grand total of ovtr six and one-half million dollars.



THE MINNEAPOLIS PARK SYSTEM.

II. Bridge No. 1, at Lake Calhoun, 50 feet span, 12 feet head room, 114 feet width, including 28-foot roadway, 36-foot parkway, two car tracks on 12-foot centers and two 10-foot sidewalks. Reinforced concrete to carry two interurban cars, 20 tons per axle, or a 16-ton road roller. William P. Cowles, designer. Cost, $54,000.

The Park Possessions

A brief description of the park system will tend to give a general idea of the park possessions:

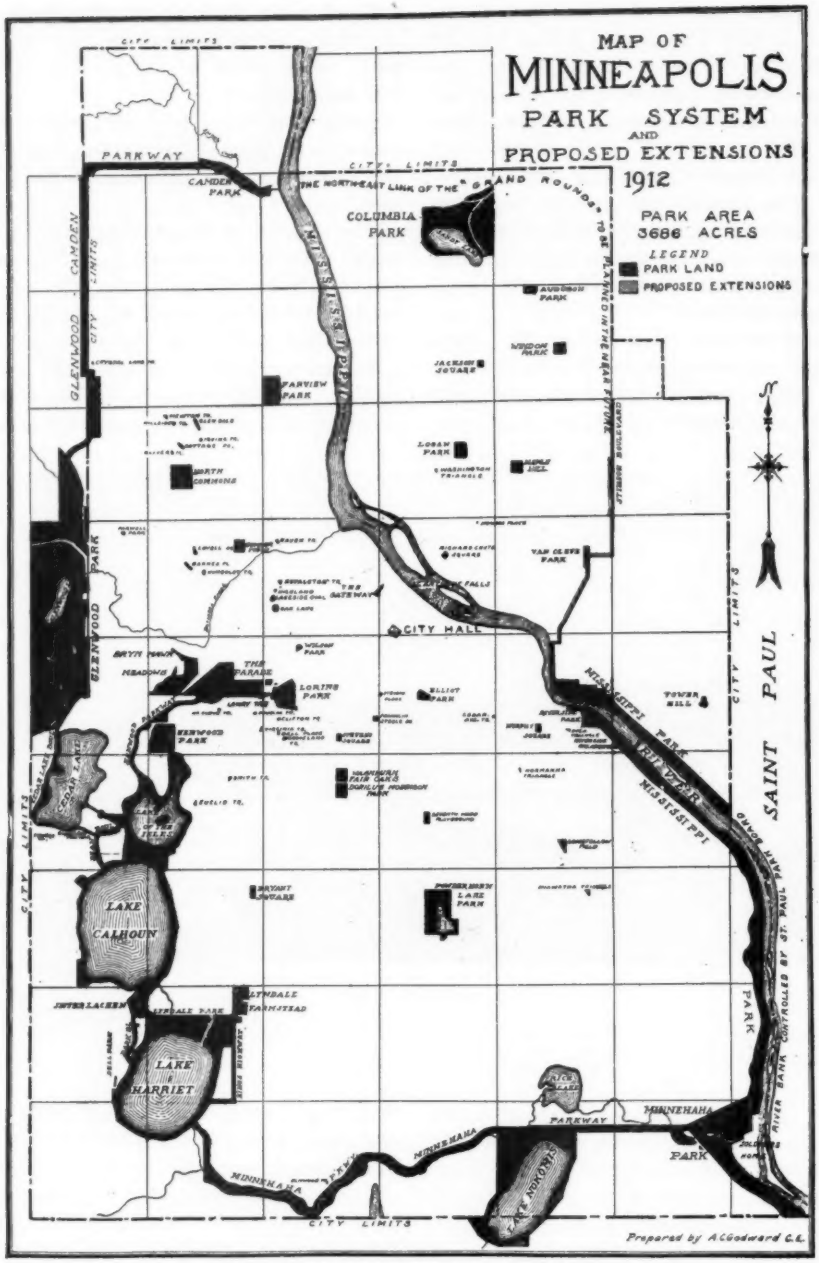
A glance at the city map (Plate I) emphasizes the wisdom and forethought that secured such a comprehensive and well-distributed system of parks and parkways, and a casual study leaves a marked impression of the generous way in which nature endowed the system with lakes, falls, river, creeks, woods, hill and meadow.

Loring park, of 36 acres, was named in honor of Mr. C. M. Loring, known as the "Father of the Minneapolis Park System."

The system of parkways starts at this point, and for a distance of seventeen miles one travels continuously on park lands, connecting many of the principal parks thru varied and beautiful scenery.

Kenwood parkway, starting at Loring park and going west, skirts The Parade, a large open space of sixty-eight acres, ideal for a playground and athletic field, and thru a fine residential district past the wooded and rolling Kenwood park of thirty-three acres, and connects us with the chain of magnificent urban lakes with finely wooded shores and splendid encircling boulevards.

Lake of the Isles, of 107 acres, is the first and rightly called the most picturesque, with its islands and irregular shore line. Next is Lake Calhoun, of 460 acres, the largest of the system, much used for sailing, boating and other water sports, and the location of a splendid bath-house.



THE MINNEAPOLIS PARK SYSTEM.
I. Map Showing Location of Parks and Boulevards.

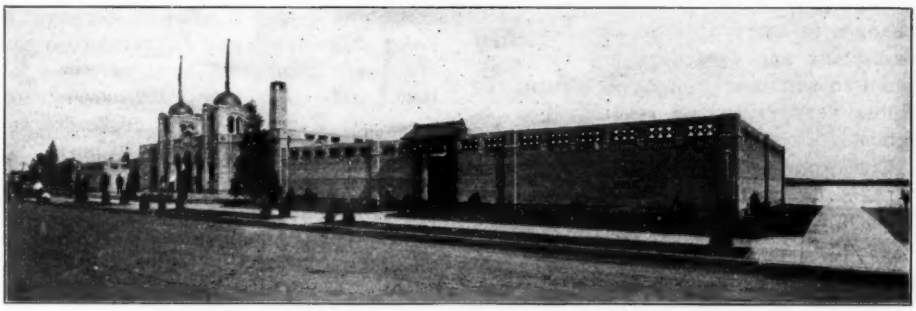
A little farther south is Lake Harriet, of 353 acres, the favorite recreation spot of park visitors. Free concerts have a great deal to do with the popularity of this resort, as well as spacious picnic grounds, canoeing, boating and fishing.

Minnehaha parkway connects with Lake Harriet boulevard, and in an easterly direction follows the winding course of Minnehaha creek thru natural scenery of hill and dale the whole distance of five and a half miles, past Lake Noko-

mis, of 295 acres, and then bringing us to that romantic spot called Minnehaha park, of 142 acres, and considered by many the gem of the park system. Here we have the celebrated falls immortalized by the poet Longfellow.

From here we follow the course of the Mississippi river along the west bank in a northerly direction. The boulevard is constructed on the bank high above the river, and the land between the drive and the river is rolling, irregular of contour and finely wooded.

For a distance of three and a half miles we travel along the west bank thru attractive natural scenery and get occasional glimpses and again unobstructed views of the Mississippi river and gorge. At Franklin avenue we cross over to the east side, which is also controlled by the park board for a distance of two and one-half miles. The river road east connects with the grounds of the University of Minnesota, and brings us within three miles of our starting point at Loring park.



THE MINNEAPOLIS PARK SYSTEM.
V. Bath House at Lake Calhoun.

There are many other parks, large and small, embracing a general plan of large and medium-sized neighborhood parks at convenient distances throughout the city, there being 85 in all, ranging from one acre or less to 584 acres.

The largest and most prominent is Glenwood park, of 584 acres, the great scenic park of the system, and within easy reaching distance. This grand natural park of hill, meadow, woods and lakes will soon be linked with the system of parkways thru connection with the Cedar Lake boulevard from Lake of the Isles. Many of the other parks will be directly connected with the boulevard system as soon as the "Grand Rounds" system is completed.

Parks Ten Per Cent. of City Area

The following extract, taken from President W. F. Decker's report in the last annual park report, gives an idea of park area in comparison with population:

"Assuming that our present population is 325,000, our park area, exclusive of water, allows 322 square feet, or more than one square rod for each inhabitant.

Don't Keep Off the Grass

Theodore Wirth, who won country-wide recognition for his work at Hartford, Connecticut, was given the superintendency of the Minneapolis parks January 1, 1906. His capability, initiative, executive ability and enthusiasm have accomplished results.

Perhaps no single action won Mr. Wirth more approval than the order consigning to the dump all the "Keep off the Grass" signs, and the abolishing of fences designed to deny the people the free use of lawns and park territory. It established the principle, "The parks belong to the people."

The Modern Improvements

Below are outlined briefly some of the more important improvements completed or started during the past six years, and what is planned for the future:

Probably no other single improvement has been so important and generally ap-

preciated as that of Lake of the Isles, where, primarily thru dredging operations, a complete transformation has taken place. The former swampy and marshy land is now fine lawns enhanced by thrifty tree and shrubbery plantings, and winding walks along the lake shore, as well as fine encircling boulevards, permit the enjoyment of the natural picturesque scenery. Material dredged from the lake has been used for raising the boulevards from one to eleven feet above the old grade, and the shore lines are covered with sand from the same source.

The dredging operations proved a much more difficult piece of work than anticipated on account of the peaty, light and floating character of the greater part of the material handled, and the deceiving, unstable and shifting underlying strata. As the work progressed, many changes to shore lines became necessary and plans and procedure had to be altered to suit new conditions, yet on the whole very gratifying results were obtained.

The dredging was done under contract at 12½ cents per cubic yard, and over 500,000 yards of material were handled, hydraulic and orange-peel dredges being used.

The cost of the improvements has been as follows:

For dredging operations covering four years' work	$70,330.01
Grading of grounds, fertilizer, seed and seeding	30,557.96
Four miles of walks, excavating peat and filling in with gravel	2,614.64
Filling, grading and rolling of 2.86 miles of roadways	20,498.90
First oiling of new roadways	3,383.02
Curbs and sidewalks	1,694.86
Catch basins and one mile of drains	4,986.70
Preparation of planting spaces, loam, plants and planting	8,801.17
Engineering, soundings, inspection, estimates, etc.	5,704.30
Miscellaneous labor, material, etc.	3,508.04
Total	$152,079.42

Cost per acre, $760.40.

One season's work, mainly plantings and cultivation of lawns, will complete the improvement.

The long considered project of a waterway connection between Lake Calhoun, Lake of the Isles and Cedar lake, has been partially carried out. The two former lakes were united last year, and the connection was partly made with the latter.

The dredging of the lagoons and waterways presented no difficulties, but the building of the necessary parkway and railroad bridges proved a large and expensive undertaking. Prizes were offered for competitive bridge designs, and twenty different designs were submitted and selections made therefrom.

Bridge No. 1 (Plate II), the largest, and of a dignified, attractive and very pleasing design, is located at Lake Calhoun. It is of reinforced concrete construction with granite facing, and cost about $54,000.00.

Bridges 3 and 4 span waterways at Lake of the Isles, and are reinforced concrete structures with Bedford stone facings, and cost about $32,000.00 each. They are a credit to the designers and are much admired for their beauty.

Bridge No. 2 is a concrete railroad bridge built in harmony with the other structures and surroundings, and cost about $26,000.00.

Located at Lake Calhoun, on the north shore, is the recently finished, up-to-date and splendidly arranged bath-house (Plate V). It is of a pleasing design, concrete construction, fire-proof throughout, and cost $65,000.00. There are separate departments for men, boys, women and small children, an emergency hospital, shower baths, etc., and a warming room to be used in connection with the skating rink in winter. Pure drinking water is supplied from an artesian well to the sanitary drinking fountains.

In connection with this building the finest inland bathing beach known has been constructed by the pumping of about 100,000 cubic yards of sand out of the lake by hydraulic dredge, at an expense of $16,000.00. The beach is 1,400 feet long and 150 feet wide, gradually sloping out into the lake. At night the beach is illuminated by flaming arc lamps. There are accommodations for

1,300 bathers at one time, and yet it has time and time again been crowded beyond its capacity.

Playgrounds the Most Useful Feature

Of inestimable value, and the one thing that has more than anything else increased the real usefulness of the parks for the masses, has been the introduction of playgrounds. There are now eight modern, well-equipped and properly supervised playgrounds. Several additional spaces have been purchased and will be improved and equipped next season. In many parks, outside of those mentioned above, play apparatus, such as swings, teeters, merry-go-rounds, sand boxes, etc., have been installed. The apparatus is of substantial, permanent construction and built and installed by the park working force, with the exception of patented fittings, etc. An idea of the various play and recreation features may be had by mentioning a few that come to mind: Twenty-two tennis courts, 22 skating rinks, 4 hockey rinks, 6 baseball diamonds, 7 field or shelter houses, etc. Opportunities for canoeing, sailing, bathing, fishing, ice-boating, boating, skiing, coasting or skating are unsurpassed for unlimited numbers. Equipment of playgrounds has cost, including season of 1911, about $15,000.00, and supervision and maintenance $10,000.00. The attendance last season was about 500,000, and is steadily on the increase from year to year. The playground department is under the direction of a capable and experienced supervisor, and he has a staff of ten instructors.

Factors in Efficiency of Management.

Below are mentioned some of the things that have contributed, in a general way, to the usefulness and efficiency of the park department:

The discontinuance of privileges and the conducting of the refectories and refreshment stands by the park board under a special department, insuring good service, pure foods and unadulterated drinks at fair prices, any profits being used for general park purposes.

The purchase of a well-drilling outfit and drilling of wells in different parks and squares to secure pure drinking water, especially at playgrounds, picnic groves and neighborhood parks.

The building of permanent machine, carpenter, plumbing, paint and blacksmith workshops.

The organization of a competent engineering department.

The establishing of a special forestry department to look after street tree planting, trimming, etc., and general forestry and planting work in the parks; of a nursery and a greenhouse plant capable of supplying the increasing demand for plants for floral displays. Flower shows are held annually.

MINNEAPOLIS PARK SYSTEM.
THEODORE WIRTH, SUPERINTENDENT.

The reorganization of the park police force with a chief of police in active charge.

The spending of over $10,000.00 per year for free music, and thru the use of a portable band stand on wheels, concerts are now held in nearly all parks of the system.

The oiling of boulevards to lay the dust, which has been found much more satisfactory than sprinkling with water, and cheaper.

The construction, at Lyndale Farmstead, of an administration building containing offices and the superintendent's residence.

EDITORIAL COMMENT

PLAYGROUND DEVELOPMENT

The reports of park development which have been received this year give much space to the playgrounds and recreation areas for children and their elders. The idea has been in mind for many years, but has not developed rapidly, partly because no one seemed to know how the grounds should be managed to make them useful and give a moral uplift rather than a tendency toward demoralization.

It is now quite fully recognized that young people from the youngest up need instruction as to how to play, and supervision to keep them out of mischief. The most hopeless looking crowd to be found is one seeking amusement about the city summer gardens, white cities and the like. They wander from one sensation to another without satisfaction, and the search for amusement degenerates into a method of killing time, if it is not worse.

The public play and recreation grounds have been little better, except that sensational apparatus and exhibitions are usually absent, but a new spirit is taking hold and the improvement is already beginning to show. What this results in for the small children is indicated by the results reported in Cincinnati, elsewhere in this number. Kansas City and Minneapolis report similar results in less detail.

The annual report of Secretary H. S. Braucher, of the Playground and Recreation Association of America, shows how widespread is the movement. Thus forty cities report supervised playgrounds opened for the first time this year. The number of cities putting this work in the charge of commissions has increased from twenty-four to thirty-seven. The cities using school houses as recreation centers number forty-eight.

That a definite recreation policy is necessary is shown by the employment of trained recreation secretaries or playground directors. The rather incomplete list in Mr. Braucher's report shows twenty-three cities which have recently or will shortly appoint such supervisors.

DEMAND FOR PROFESSIONAL MAYORS INCREASING

The city of Arkansas City, Kan., having a population of about 7,500, is seriously considering a form of charter for cities of its size which shall remove the objections to the commission form of city government and retain its advantages. A form of bill prepared by Geo. B. Irving, of Chicago, is under special consideration and contains many valuable provisions. One of

the most valuable is that providing for a competent mayor and the method of securing and appointing him. He is to be appointed by the elected directorate, of five members in the smaller cities, and must fill "so far as possible" the following rather large order: "An expert municipal engineer with knowledge of municipal law, municipal engineering and sanitation, civic landscape, the management of public utilities, for example, street car service, water and light supply, police and fire protection, and such other information upon municipal and sociological subjects, and particularly such questions as concern capital and labor." Not satisfied with this phenomenal character, the bill would make the mayor serve also as the secretary of the local commercial club and he must "have a knowledge of the duties of the industrial secretary which will enable him to perform the functions of such position in a manner to promote the business and aesthetic interests of the city." Arkansas City could pay such a man $4,200 a year, the salary being graduated from $1,800 for a city of 3,000 or less population to $100,000 for one of a million. He can be taken wherever found and contract for four years of service must be made with him.

The provisions of this bill are somewhat more liberal than those in the South Carolina law providing for a municipal business manager, in that the mayor is given more power and is not subject to so much petty interference by the directorate but it is possible that the South Carolina law will work better in practice because it calls for a man of ability, to be sure, but not of such transcendent ability that his like cannot be found.

RELATION OF COMMERCIAL ORGANIZATIONS TO CITY GOVERNMENT

One provision of Mr. Irving's plan for city government seems to the writer to be based upon a misunderstanding of principles and relations. It is that providing that the city's commercial club shall have its rooms in the city hall and shall have the mayor as secretary. In small cities where everybody knows all that is going on and the amount of business is so small that one man can take care of both offices, economy and efficiency may be promoted by combining the two offices, but the limit is soon reached.

The operation of the machinery of a city, its housekeeping, its public improvements, its bookkeeping, is a very different problem from its promotion and its advertisement. The problems are so very different that they require men of very different temperaments and attainments to attack them successfully.

This close relation of the promotion and the operation of the city is of advantage in securing prompt action upon plans for civic betterment, for the club in its discussions and in its instructions to its secretary is speaking directly to the executive of the city, and the executive can speak directly to the leading men in the city. But he can do this under the present system if he so desires. The mayor, moreover, is under the control of the city directorate, the members of which may stand upon their dignity in case the club issues orders to its secretary which do not conform with the opinions and desires of the directorate as the real employer of the mayor-secretary.

THE QUESTION DEPARTMENT

Should Engineer Give Bond for Professional Service

It it professional under any circumstances for an engineer to give or offer to give a surety bond for the faithful discharge of his duties as engineer?

W. Columbus, Miss.

There has been much discussion of this subject, and it has been generally considered that an engineer should not give a surety bond for the discharge of his professional duties. He can, of course, properly give such a bond for the financial part of his work, if he has such. There is, however, an opinion held by a few that an engineer should be willing to give bond covering his professional work, also. The argument on which this is based is, that a man who could secure such a bond would have the confidence of those willing to risk a considerable sum on his competence, and so a more competent engineer would be secured than if the bond were not required. Actually, however, the requirement of a bond is seldom, if ever, made by persons able to judge the qualifications of an engineer, and so the cases in which the question must be considered are almost certainly among the less important. from the engineering point of view, and probably the financial, also. The competition is likely to be, therefore, between the man claiming to be an engineer and the real engineer engaged in this less important work. The latter needs all the protection he can get from the consequences of the ignorance of his prospective employers; and, if he has the confidence of himself and his friends who can back him, the requirement of a bond will be an influence in his favor.

Many city engineers are under bond, but these bonds are not, strictly speaking, bonds as engineers, but bonds as city officials.

Blow-Off Valve on Inverted Siphon

I have in mind several locations where I may have to siphon sanitary sewers under streams. In such siphons will blow off valves be advisable or will thorough flushing of the system once a day remove any tendency to clog the siphons.

S. E. ———, Okla.

A blow-off valve in an inverted siphon is excellent, if one can be put in, but that means enough fall in the stream to allow it to discharge without the water in the stream backing into the sewer. It may be found that as frequent flushing as once a day is not necessary. The pipe through the siphon should be smaller than the general size of the sewer, so as to keep up as nearly a maximum velocity as possible. Manholes should be put in at both ends, so that the pipe can be cleaned by hand when necessary. Unless flushing is very copious, the changes in direction and velocity of flow will be such as greatly to reduce the efficiency of the extra flush in removing deposits. One of the new forms of sewer cleaner could be used here to advantage, as they loosen and stir up the solid matters so that they can be carried away by the flushing stream. The reduction in velocity in the manhole or pipe in which the sewage arises from the inverted siphon to the outlet sewer will still make hand cleaning of that manhole or pipe necessary.

Filling Water Pipe Trenches in Macadam Road

We are building some state roads through this town and the water company's pipe line will come underneath them in some places. When the line was put in it was not properly calked and we frequently have leaky joints We have dug up several under this road which is not yet completed, and they have requested us to fill the hole with stone and they have completed it with their other work. What will be the best way of fixing these leaks after they are gone?

The company, of course, will have no twenty-ton roller to finish it with. In other words how is it done in other places?

L. Supt. Water Works ———, N. Y.

The trenches or holes dug in the roads hereafter can be filled satisfactorily with stone, if as much fine material as is necessary to fill the voids in the stone is used and the material is tamped or flushed with water as the fill is made, according to the nature of the surrounding soil. Flushing with water will not be good if the soil is clay or other impervious material. By carefully filling and tamping, the road can be brought up to

a good surface, which will settle but little, if any.

Ordinance Establishing City Purchasing Agent

We wish an ordinance to cover the scope of a purchasing agent's business.
CITY ATTORNEY.

Can our readers send us copies of such ordinances?

The purchasing agent is usually an employe of the board of public works, the comptroller or the mayor, and in such case the ordinance would be very simple, details being left to the head of the department.

Staunton, Va., has a business manager, and the ordinance governing him would doubtless be of service to our correspondent. A copy of it would doubtless be sent by the city attorney or by C. A. Ashburner, the business manager.

Ordinances Governing Poles and Wires

I will be glad to have you give specimen of ordinance granting franchises to corporations to erect poles and stretch wires along and upon the streets of the municipality.
F., City Attorney, ———, Ga.

A very simple ordinance reads as follows:

1. Give routes of the lines of wires for which permission is granted.

2. In case said city shall be sued for any damage done to any person or property in said city by the erection of its said poles and wires, or the subsequent maintenance thereof, it shall appear and defend the same; and should said city be held liable for any damages so sustained, said company shall be liable to said city for all sums paid by her on account thereof, with 8 per cent. interest thereon, and said judgment against said city shall be conclusive against said company.

3. In case said company or its successors or assigns, shall at any time merge or consolidate the same with any other telegraph company or lease to or otherwise turn over its said line of telegraph to said company then, and in that event, the rights hereby granted shall be null and void, and the poles and wires of said company may be removed from the streets and alleys of said city. The council hereby reserves the right to impose a tax or charge of not less than $2 nor more than $5 per annum on each and every pole of said company erected on the streets and alleys of said city for the privilege it enjoys in maintaining its poles thereon.

4. No pole shall be erected upon any street or alley hereinbefore named at any point which does not meet with the approval of the city civil engineer of said city; and the council hereby reserves the right to require said company to remove its said poles from one point to another on said streets and alleys whenever, in their judgment, the public interests demand such removals.

5. Said company shall place guards around all excavations made by it when laborers are not at work at such points, and shall fill up all such excavations in two days from date of notice so to do by the street commissioner or other agent of said city.

6. Said company shall observe and comply with the provisions of all ordinances of said city, and in default thereof this ordinance may be repealed at any time, and when so repealed all rights hereunder shall immediately cease.

This ordinance lacks one provision, as the city in which it is in force found when it attempted to place the wires underground in certain parts of the city. A provision giving the city the right to order wires underground should be included.

As a city grows the necessity for closer control of wires, poles and conduits becomes evident, and the contracts with telegraph, telephone, light, power, and other companies become more complicated and it becomes necessary to make contracts or ordinances for each class of companies and uses of wire.

Determination of Burnt Asphalt

I have not seen any statement showing how it may be determined in a ready way, whether in distilling the volatile portions of natural oils, the asphaltum that is used in road construction has been burnt. If you can advise me how this may be readily determined, so that burnt asphalt may not be allowed in street construction I will appreciate your action very much.

I think that at least some of the cases where there have been unsatisfactory results obtained in using oil asphalts, the failure can be attributed to what might be termed destructive distillation.
T., Tampa, Fla.

Discussions which will throw light on this problem will be found in articles on "Control and Onwnership of Asphalt Pavements" in MUNICIPAL ENGINEERING, vol. xxxvii, p. 301, and "The Value of the Carbene Requirement in Asphalt Specifications," vol. xxxv, p. 349.

The proportions of free carbon and of the hydro-carbons are changed by the coking of the asphalt, so that the effect of over-heating the asphalt is readily seen, if not by direct examination of the product, certainly by simple chemical determinations.

Will our readers suggest methods which they supply to their inspectors for determining this fact?

Methods of Testing Asphalt and Coal Tar

Would you kindly tell me where I can find the standard methods of testing asphalt, asphaltic cements and coal tar products?
STATE HIGHWAY CHEMIST.

MUNICIPAL ENGINEERING numbers for May and August, 1911, vol. xl, pp. 417, 437, and vol. xli, p. 342, contain the specications desired. The proceedings of the American Society for Testing Materials, Edward Marburg, secretary, University of Pennsylvania, Philadelphia, contain the standard methods and descriptions of the standard apparatus.

Articles on Electric Conduits

Have you published anything on the subject of underground systems of electric wire conduits in recent numbers?
E. M. H., Burlington, Vt.

Following are valuable articles in recent numbers of MUNICIPAL ENGINEERING:

"Electric Wire Conduits at Westfield, Mass.," vol. xlii, p. 220.

"Underground Electric Distribution," vol. xlii, p. 362.

"Conduits of the Lincoln Park Electrical System," vol. xl, p. 443.

References to some new systems and sources of information about them are given in vol. xlii, p. 306.

Permission to Lay Pipe in Private Street

Do you know of a special form of application for water for consumer (property owner) to sign for water service, the granting of the application making it necessary for the water company to lay water mains through the streets of private property, that is, a development whose streets have not yet been turned over to the town or county. In order for a company to lay mains in such streets it would be necessary for them to have a release from the property owners for an easement in such streets, which would give the water company the full right to lay and maintain water mains indefinitely. In your special service department if you have any data respecting this subject I would be glad to hear from you.
E. M. L., New York.

Those who lay out plats such as that described and those who purchase lots therein are generally very anxious to have water and gas mains laid in the streets, because of the material enhancement of the value of the property. If, however, lots have been sold including therein ownership of the streets and the streets have not been legally dedicated or have not become public by reason of use by the public, it might be possible for objecting property owners to make much trouble if not entirely to prevent laying of such mains in the street through their property to reach property beyond, although the pipes are to be laid in the street. The character of the right-of-way in the street, granted by the plat from which the lots are sold, would have much influence in this decision. Possibly the law of eminent domain could be invoked. The question is one for an attorney versed in the laws aud court decisions in the State and who can ascertain the exact legal conditions surrounding the particular case.

Have our readers any cases in mind which would aid our correspondent?

Best Material for Water Supply Line.

I need about 1,000 feet of 10-inch tile to run up through a swamp and tap an artesian well about twenty feet below the surface. This is the height to which the water comes in a strong flow, about seventy-five miners inches. I have here clay in abundance, sand and lime rock which could be burned. Cement is quite high and especially so as my funds are about exhausted. Now what is the cheapest possible way that pipe can be made here and how? The clay when molded by hand in common hand made molds takes a long time to dry enough so it can be taken out of the molds and then it cracks. How can I utilize it? Will they have to be burned?
H. G. ———, Chihuahua, Mex.

As it would take not more than twenty barrels to make the amount of pipe required, and limestone is at hand to be broken up to the required size of particles for aggregate at low cost for labor, it would seem from this distance that the cement pipe would be much the cheapest. The dried clay pipe would not serve, and the cost of providing kilns and burning the tile would far exceed that of cement, especially for so small a quantity. Possibly the clay is not suitable for making pipe strong enough for the depth of fill stated, and this should be determined if the use of the clay pipe is seriously considered.

Why not use bored logs if the earth about the line of pipe is always saturated with water, and timber is available?

Have our readers any suggestions to offer?

Ordinances Governing Automobiles in Cities

We are trying to frame a new automibile and vehicle ordinance and would like to know what others are doing.
H., City Attorney, ———, Vt.

Ordinances covering various parts of the field will be found in MUNICIPAL ENGINEERING, vol. xliii, pp. 38 and 388. These are simple but comprehensive. The Cincinnati vehicle ordinance is perhaps as inclusive and elaborate as any which has been put in force.

FROM WORKERS IN THE FIELD

Creosoted Wood Block in Atlanta, Ga.

The Editor of MUNICIPAL ENGINEERING:

Sir—Since 1897 we have, in the city of Atlanta, laid 121,011 square yards of creosoted wood block paving at a total cost of $327,702,88, or at an average of $2.55 per square yard. These streets, totaling 25,446 linear feet, carry our heaviest traffic and are in excellent condition, and have been maintained at practically no expense.

Our creosoted wood blocks are of southern long-leaf yellow pine, 90 per cent. heart, 3 to 3½ inches in depth, 3 inches in width and from 6 to 8 inches in length, with the fiber of the wood running in the direction of the depth.

Shorter blocks than those above specified are only used in the starting of courses or in making of closures. Twenty pounds of creosote per cubic foot of wood is required.

We are more particular than most cities in seeing to it that the three courses, laid next to and parallel with the curb, are strictly parallel from a mathematical viewpoint, and that the blocks are driven tightly together.

Our expansion joints are filled with No. 6 coal tar paving pitch, pouring at a temperature of 300 degrees F., and our close inspection guarantees it to be a durable and adhesive filler. We use a clean sand cushion one-half an inch in depth. Perfectly uniform surfaces are required.

Creosoted wood block paving is used so extensively in our business district, not only on account of its durability under heavy traffic conditions and low cost of maintenance, but on account of its noiselessness. The question of noise in the business district of our large cities is becoming a serious matter. Creosoted wood block paving has certainly done its share in doing away with the roar and din of traffic.

BROAD STREET, ATLANTA, GA., LOOKING NORTH INTO PEACH TREE STREET. PAVEMENT LAID IN 1908.

We keep our streets washed by means of high pressure flushing machines, and we find creosoted wood very easy to clean. It does not pulverize, wear away and grind into dust. The absolute smoothness makes sweeping and cleaning an easy matter, and it does not require frequent sprinkling. Its evenness of wear is also an important matter when it comes to the question of street cleaning at a minimum expense. Its freedom from dust and mud is appreciated by our street-cleaning bureau.

Any pavement to be thoroughly satisfactory must also be sanitary, and I consider wood block very satisfactory in this respect because the blocks do not absorb

street filth, the joints are not open for the absorption of refuse matter, and the creosote treatment destroys germs.

Durability is one of the prime requisites of a street pavement. Once a street is paved it is always to be a paved street. If the pavement is not durable the time will soon come when a new pavement must be paid for. The only test for durability is long and efficient service at the smallest average annual cost for upkeep and maintenance.

R. M. CLAYTON,
Chief of Construction, Atlanta, Ga.

Boulevard Pavement Must Stand Traffic

The Editor of MUNICIPAL ENGINEERING:

Sir—The automobile is the vehicle we must reckon with in these days, and in the laying of asphalt park drives and boulevards we look upon each job as an engineering proposition. In every instance great care is taken that the wearing surface be composed of such constituents, properly graded, as will conform to traffic conditions. On the boulevards of our park system the surface mixture is so kneaded and compressed by heavy traffic as to afford a greater resistance to the deleterious effect of moisture and the chemical action of the air than on light traffic drives, where such kneading process is lacking; consequently, less bitumen and oils are required on main thoroughfares and a harder pavement may be laid. In order to withstand atmospheric conditions successfully, a softer pavement is necessary on light traffic drives, and contains a larger proportion of oils and bitumen, which gives a high penetration.

In the West Park System we have laid many miles of Cuban natural asphalt concrete pavement with great success, and I might add that the amount of traffic in the West Chicago Park System is an excellent test for any kind of pavement.

Our drives show little disintegration and have a fine granular surface, which insures a good footing for either automobile or horse. These streets retain their contour, showing no movement during hot months, nor do they become brittle during the cold months. Our binder is laid at a temperature of about 250 to 300 degrees F., and consequently does not chill through contact with the cool concrete base before it can be properly raked and compressed. We operate our own Twentieth Century portable asphalt paving plant, and consequently have few delays. Raw materials can be hauled more economically than the prepared mixture, as regularity and speed of delivery are of less importance. Batches of prepared material can be more advantageously delivered on the street, and more evenly and economically spread in place in small quantities wheeled in carts or barrows than in large loads brought in wagons.

The following tables compiled by the West Chicago Park Commissioners give the total number of vehicles passing a given point as shown below for a period of twenty-four hours on the dates given:

ON BOULEVARDS.

Ashland, at Jackson.

Sunday, Sept. 17.

	Autos.	Horses.	Cycles.
7 a. m. to 3 p. m..	1,206	188	394
3 p. m. to 11 p. m..	1,601	177	385
11 p. m. to 7 a. m..	320	40	68
Totals	3,127	405	847
Total for day.....			4.379

Washington, at Forty-fourth Avenue.

Monday, Sept. 18.

7 a. m. to 3 p. m..	1,885	251	521
3 p. m. to 11 p. m..	3,180	389	498
11 p. m. to 7 a. m..	308	43	76
Totals	5,373	683	1,095
Total for day.....			7,151

Jackson, at Halstead.

Sunday, Sept. 10.

7 a. m. to 3 p. m..	2,135	414	376
3 p. m. to 11 p. m..	2,240	220	345
11 p. m. to 7 a. m..	518	125	122
Totals	4,893	759	843
Total for day.....			6,495

Oakley, at Jackson.

Thursday, Sept. 14.

7 a. m. to 3 p. m..	306	123	248
3 p. m. to 11 p. m..	480	175	264
11 p. m. to 7 a. m..	85	35	17
Totals	871	333	529
Total for day.....			1,733

Sacramento, at Jackson.

Monday, Sept. 11.

7 a. m. to 3 p. m..	280	125	134
3 p. m. to 11 p. m..	400	107	217
11 p. m. to 7 a. m..	85	28	55
Totals	765	260	406
Total for day.....			1,431

The laying of our asphaltic-concrete pavements, with our own plants and employes, has been exceedingly successful. During 1911 the area paved was 137,559 sq. yds. at a cost of $84,236.02, reducing this cost to 61¼ cents per square yard. This is a reduction of a little more than 6 cents per square yard as compared with 1910.

F. J. GREEN,
Superintendent of Paving,
West Park System, Chicago, Ill.

Ornamental Lighting in Waterloo

There is no defect in the general make-up of a city that so detracts from its appearance as poorly lighted streets. On the other hand, there is no improvement that so adds to the general aspect as a well-equipped system of illuminating thoroughfares, especially those of the business districts.

The transformation of the down-town district of Waterloo from a commonplace business center to a site of beauty and brilliance has been one of the greatest moves ever made in Waterloo.

The first step was that of lighting the Fifth-street bridge. Turning on the light in this locality had a stimulating and moralizing effect. It is no longer a lounging or loafing place, and is now regarded as a safe crossing for even the most timid pedestrian.

Following the installation on the bridge the enterprising merchants between Sycamore and Lafayette streets took the initiative and installed the system. After the lighting of one block on Fifth street came an extension up Sycamore one block to Fourth, up Lafayette one block from Fourth to Park avenue.

The benefited property owners pay the cost of installation. The city then assumes the maintenance and current expense. The initial cost is about $1.25 per running foot to the merchants installing where there are four lights to the block.

Ordinance No. 704, which fixes the standard for ornamental lighting posts and fixtures, provides in part as follows:

"The post or standard shall be 13 feet and 6 inches from the curb to the center of the top globe, and shall provide for four side and one top vertical upturn lights. It shall be equipped with roughed inside ball globes. The four side globes to be 12 inches in diameter and the top globe 16 inches in diameter. The total estimated weight of the post and fixtures shall be 1,000 pounds.

"Be it further ordained that the owners of property abutting on any street to be lighted with boulevard lights shall purchase and install said posts and equip them with lights.

"Be it further ordained that upon installation of boulevard or street lighting posts upon any street, said posts shall be placed ninety (90) feet apart, four posts on each side of each block, the posts nearest the corner to be located fifteen (15) feet from the outside property line of the corner lot.

"Be it further ordained, upon the installation of street lights, posts and fixtures in compliance with the standard and regulation above provided. the city of Waterloo shall have complete control and regulation of the said boulevard lights, and shall designate the hours during which said lights shall be illuminated.

"Be it further ordained, that if the owner of any property abutting on any street in the city of Waterloo shall install or attempt to install any street lighting posts and fixtures which do not comply with the specifications of the standard post and fixtures herein described, he shall be guilty of a misdemeanor and fined not less than ten dollars ($10) nor more than fifty dollars ($50)."

Ordinance No. 2617 establishes a boulevard lighting district under conditions provided in ordinance No. 704.

Ordinance No. 2711 designates the watt power. Where there are five ornamental lighting poles to either side of a block, the four side lights are 40-watt and the top light 60-watt.

We consider the arrangement whereby the property owner pays for the cost of the ornamental post complete, including installation, and the city assuming the expense of maintenance and current, as being ideal in every respect.

One hundred and sixty-eight ornamental posts are already installed, and further installations will continue to be made until the work of properly lighting the entire boulevard district is completed.

We have now in operation, including the Fifth-street bridge, 185 ornamental standards. The top lamps burn on an average of 3,850 hours per year and the lower four lamps 1,540 per year.

185 posts at full candle power, 1,540 hours, 62,678 k. w. per year.

185 posts at 60 watts, 2,310 hours, 25,641 k. w. per year.

Total, 88,319 k. w. per year.

88,319 k. w. at 5½ cents, $4,857, total cost for electricity consumed in 185 posts.

Average cost for renewals and breakage of lamps and globes per post is $3.25 per year.

Number of lamps installed: 1910, 32 posts; 1911, 104 posts; 1912, 32 posts; total, 168 posts. This does not include posts on bridge.

We have been put to very little expense on account of breakage of globes, and the cost of maintenance and current is slight.

There was considerable speculation as to the additional cost entailed on the city's light fund by the installation of the boulevard lights. An investigation of the itemized expense account of the light fund reveals that very little increase is noticeable. The average cost per block per month of the cluster lights is $25. The lowest amount paid for any one block in a month was $18.32 for the block on Lafayette street between Park avenue and East Fourth street. The block on Jefferson street between West Fifth and Sixth streets cost the city $38.17 during

the month of November. Variations in the monthly cost of cluster lights are caused by failure of the night officer detailed to extinguish the lamps.

The ornamental lighting standards, as used, are of a proper mixture of strong pig iron and steel, and are made by the Waterloo Malleable Iron Works. The wiring is easily accessible, yet protected from injury by any cause. The lamp bowls on the arms are interchangeable with the ornaments, and their position may be reversed if at any time it is desired to hang lamps below the arms. The globes are arranged so as to give proper diffusion of light on the show windows, walks and streets. The height of the globes is sufficient so that pedestrians will not be inconvenienced by the glare in their eyes, and yet not so high as not to properly illuminate the street. Lower standards and less powerful lights would mean more standards and more current. The globes are upturned in order that they radiate over a large area, as down-hanging globes concentrate the light in circular spaces.

Charles A. Roby,
City Engineer, Waterloo, Iowa.

accumulated in their sewers from a depth of three to fifteen inches.

We pay careful attention to our sewers in this city. We keep all decomposed matter and roots out by means of turbine machines. We keep the pipes as free and as open as when first laid. Our machines clean and scour sewers, from eight to thirty inches, at a cost of from three to seven cents per lineal foot. The first sewers which we cleaned were 8-inch, and they were in an exceedingly filthy condition. The cost per foot for the first three blocks cleaned was 3.28 cents per foot.

The city of Winnipeg, Canada, spends $30,000 a year to deodorize its sewers. In a great many cities there is a fungus growth on the walls of the pipe, and by the use of the machine this is all eliminated, as it revolves around on the inside of the pipe with about the same velocity as an electric fan, picking up the sand and whirling it around. We also disinfect the sewer at the same time, or it can be done after the cleaning process.

G. M. Downing,
Commissioner of Streets and Public Property, Tulsa, Okla.

WASHING ASPHALT PAVEMENTS AT WINNIPEG.

Keep the Sewers Clean

The Editor of Municipal Engineering:

Sir—It is almost as detrimental to the public health to have from a two to six-inch accumulation in sewers as to have a complete stoppage. An unclean, partly choked-up sewer is a deadly menace. It is a breeding place for health-destroying germs.

Merely flushing a sewer is not sufficient, as it merely pushes most of the mass but a short distance from the manhole. Sewers must be thoroughly cleaned and then kept in a cleanly condition.

We hear a great deal about bad garbage conditions, impure milk, expectorating in cars and on streets, and fly-swatting, but most municipalities are altogether too apt to overlook the decomposed organic and vegetable matter which has

Washing Winnipeg Streets

The Editor of Municipal Engineering:

Sir—While portions of certain streets are allotted to the "white wing" with his scraper and broom, we sprinkle, wash and scrub our eighty miles of asphalt, as well as other smooth pavements, with the squeegee machine.

In the winter time we keep the sidewalks cleared of snow by means of horse-drawn snow plows. We have in the neighborhood of five hundred miles of walks within our city limits, but, owing to climatic conditions, we find it better to leave a few inches of snow on top of the walks.

At night we flush a certain number of streets direct from the hydrant, using a 1½-inch hose. We did use 2½-inch hose, but found it too heavy to handle; the

1½-inch does the work just as satisfactorily. To my mind there is only one way to clean asphalt, and that is by washing it.

While our water works system is owned by the city, the supply being from an artesian source, there is such a thing as using too much water for street purposes, and for this reason the use of our street-washing machines is eminently satisfactory, because the consumption of water is extremely small for the results obtained.

We line our squeegee machines across the street as shown in the accompanying illustration, and they clean the street from gutter to gutter. The dirt is left in a long windrow along the gutter, where it is gathered up and taken away in carts. the machines do not use enough water to wash the dirt into and thus clog the sewers. The pavements are dry a few minutes after the machines have passed.

W. F. TALLMAN,
Street Commissioner, Winnipeg, Man.

Municipal Publicity

The Editor of MUNICIPAL ENGINEERING:

Sir—Your request for an article regarding what you term my short paragraph sermons is at hand, and I will endeavor briefly to illustrate what I am trying to accomplish.

The experience of several years has shown me that "statistics" should not be put before the people frequently in the shape of a great mass of figures, which at a glance is appalling, but rather in a concise manner easily understood by the average person. How to accomplish this has been a constant study with me.

A short time ago one of our daily newspapers, which has always courteously published whatever figures this office has furnished, solicited material for a number of articles pertinent to municipal activities. Desiring to make these articles short and interesting at the same time, I prepared a number of paragraphs which have been published on the front page of the paper referred to. Some of these articles were also printed in the October 31st issue of *Municipal Statistics*.

The subject-matter, where possible, is shown in a comparative way, being brought to the readers' notice more in the light of a story, and impresses itself on the memory more readily. For instance, the citizens of Minneapolis know that we have an extensive park system comprising about 3,600 acres, but how many realize that this area would accommodate at one time a huge picnic party embracing the entire combined population of Minneapolis, St. Paul, Duluth and Superior, and there would be an average space for each person equal to a room 15x 15 feet; that the entire mileage of sewers in the city, if placed in a single line, would extend from Minneapolis to Milwaukee; that the mileage of pavements, average 27-ft. roadway, is equal to a highway extending from Minneapolis to Ashland, Wis.; that the mileage of stone sidewalk is sufficient to line both sides of a highway extending from Minneapolis to Chicago; that the mileage of lighted streets in the city, 60 per cent. being electric lighted, would make a continuous lighted thoroughfare from Minneapolis to Kansas City?

These are perhaps homely and simple comparisons, but, judging from the numerous favorable comments which we are receiving regarding them, I am of the opinion that the magnitude of the various items is better understood when comparisons are shown. Take for example the daily output of the twenty-three flour mills of Minneapolis, amounting to 71,200 barrels, which, though immense, does not particularly impress one, but when we say that these barrels rolled along the street at the rate of one per second would require twenty hours to pass a given point, or placed end to end would extend a distance of thirty-two miles, or would present a frontage of 1,000 ft. long by 220 ft. high if piled along the side of the street, ends to the front, then one begins to realize the greatness of this daily production of flour.

I have also in preparation paragraphs showing the rank of each of the thirteen wards relative to area, population, amount of taxes paid, etc., illustrated as follows: The Second ward ranks fifth in area with 2,759 acres, tenth in population with 19,000, fifth in assessed valuation, pays 7 per cent. of the total taxes. Property in the ward is utilized for manufacturing, linseed mills, grain elevators, railroad trackage, State University, residence and retail, importance being indicated in the order named.

This is an outline of the policy I am pursuing in presenting statistics in a manner which I hope will the better enable the taxpayers of Minneapolis to know their city and its municipal activities.

H. A. STUART,
City Statistician, Minneapolis, Minn.

Advantages of the Meter System

The Editor of MUNICIPAL ENGINEERING:

Sir—During the latter part of 1906 the proposition was placed before the voters of the city of Houston, Texas, as to whether the water works of the city should be purchased. For years under private management the service had been inadequate, despite every effort upon the part of the city council to remedy the

conditions, and with the past difficulties clearly in mind and with no hope for improvement, the proposition was carried by a large majority in October, 1906.

Immediately after the city assumed charge a thoro investigation was made into every phase of the plant and system, endeavoring to ascertain the specific faults and what plan to pursue to remedy them.

One fact was especially prominent, viz., negligent and wilful waste of water. The estimated waste was computed at 1,440,000,000 gallons yearly, and at that time only 108 meters were in service. Elimination of waste became at once the paramount issue, but, owing to adverse public sentiment, the city was handicapped to a great extent in adopting the meter system generally, so the policy of gradually installing meters in order to mold public opinion to their use was decided upon. It was proposed first to demonstrate the economical advantages accruing from meters, and second the conserving of the water supply so that a general reduction in rates could be made possible.

Three years have elapsed since the systematic installation of meters was commenced, and the water consumers have been benefited by securing a pure and adequate supply of water, reduction in rates, etc., while the water department has been able to make extensions and other improvements which would not have been possible under the flat rate plan.

It was deemed wise from the first for the city to own all meters, for obvious reasons, mainly to prevent the use of inaccurate meters, and to control absolutely the entire water works system. This plan has proven entirely satisfactory to all concerned.

Waste was found to be due to defective plumbing and wilful misuse of water. This was not confined to residences, but was discovered in the majority of manufacturing plants. Only 2 per cent. of the waste was attributable to leaky service pipes and mains owned by the city.

The equity and value of the meter system has long since been determined both by the consumers and the water department. Its justice is shown by charging only for water delivered. In comparison to the preposterous flat-rate plan of demanding payment for service whether given or not, this feature is very apparent even to the most prejudiced.

The value of the meter system, in addition to its financial asset, is its great aid in conserving the water supply. This alone is of vast importance to the people of the city.

In summing up the advantages resulting from the use of meters the following statistics will be found interesting: 8023 meters have been installed since the early part of 1910. In addition 277 new fire hydrants have been set, while the pumping capacity has been increased 94 per cent. The most pleasing result, however, is the substantial reduction in daily per capita pumpage, which in 1906 was 141 gallons and to-day, with an increased population of 50 per cent., it requires only 53 gallons per person. This has been accomplished without depriving any family, firm or corporation of this essential element, but is due to waste detection and stoppage.

All of the aforementioned improvements have been made without the issuance of bonds, which would not have been possible under the old system.

The chief aim of the Houston Water Department has been to serve the water consumers efficiently and to attain this end we earnestly asked co-operation from the consumers in conserving the supply and profiting thereby individually and collectively. Our efforts have been crowned with success, and the meter system has been the cause of enlisting each patron in the ranks of those whose aim is to secure an abundant and pure supply of water at a nominal price.

ROBERT L. JONES,
Water Commissioner, Houston, Texas.

Brush for Cleaning Tile Sewers

The Editor of MUNICIPAL ENGINEERING:

Sir—In re inquiry signed "E. R. W., Port Huron, Mich."

I had much success in cleaning tile sewers with steel wire brush I had made by J. Mullholland, 72 Lafayette street, New York. The brush was made on the principle of a boiler tube brush, the flat steel wires woven into a mandrel spirally 24 inches long, tapering slightly, but full 18 inches of brush full diameter of pipe to be cleaned.

At either end of the mandrel I had easy working swivel joint, to which the hauling and tail rope was attached. I found that in drawing thru sewer, if obstruction, such as roots or grease, was encountered, the swivel would allow brush to revolve and cut off obstruction and scrape surface of pipe clean. In section that showed much refuse, smaller size brush was passed thru and then brush of full capacity. At times I found it necessary to attach team of horses to line to draw thru. In bottom of manhole at invert I had two strips of oak about 24x1½x3 inches with blocks to separate them and a pulley sheave in manhole end; the other end of blocks were inserted in line pipe, and with hand winch on surface strain was directly up, causing the strain to be on wall of manhole and holding pulley in position.

A brush 24 inches long for a 10-inch sewer costs about $2.25.

W. W. DIXON, Elizabeth, N. J.

CIVIC BEAUTY

EDITED BY MYRON H. WEST

Chicago—"A City Set in a Garden"

BY CHARLES H. WACKER, CHAIRMAN, THE CHICAGO PLAN COMMISSION.

Next to convenience and orderliness in its street arrangements, the most essential thing in a great city is a park area sufficient for the preservation of the public health of the citizens. Parks of a city have been aptly compared with the lungs of a person, as means by which the city and its people get the stimulus of fresh air so necessary to normal well being.

The desire of the people of Chicago for extensive parks for their city has always been manifest. When Chicago became a city, in 1837, it chose for its motto "Urbs in Horto"—a city set in a garden; and in 1869 the people set about creating for the city a park system that should justify to the world that description of the city. In that year an agitation was begun to connect the existing parks by boulevards, and thus create a park system. This agitation succeeded, and with the addition of six of Chicago's largest parks to the city's open-air spaces the park system became the pride of Chicago.

It is universally admitted that attractive home surroundings, and those features of city life which contribute to man's judicious pleasure, are as vital in the development of a higher life as are the roof above his head and the food upon his table to his material welfare. Recognizing this, large sums of money are annually paid out of every city treasury for expenditures under the classification of "recreation."

Under "recreation" may be classed parks, boulevards, public conservatories, children's playgrounds, band concerts and other expedients that make life enjoyable to the great masses of people which make up a city's population. Chicago's expenditure for these purposes during the year 1908 was $1.43 per capita, while New York expended but 83 cents per capita for similiar purposes. The various park boards of Chicago alone expend six million dollars annually.

Chicago's present park area is divided into eleven districts—the South Park system, the West Park system, the Lincoln Park system, the Special Park Commission and seven smaller systems—the Ridge Avenue, North Shore, Calumet, Fernwood, Ridge, Irving Park and Northwest.

The South Park system, 2,495 acres in extent, embraces Jackson park, Washington park, Marquette park, Grant park, McKinley park, Gage park, Sherman park, Ogden park, Palmer park, Hamilton park, Bessemer park, Calumet park and eleven other smaller parks and squares.

The West Park system, 1,035 acres in extent, includes Humboldt park, Garfield park, Douglas park, Union park and ten smaller parks. A large new park has just been purchased which will form a large addition to this system and furnish recreation facilities for the people residing in the western section of the city.

CHARLES H. WACKER,
Chairman the Chicago Plan Commission.

The Lincoln Park system, 700 acres in extent, includes Lincoln park and several small parks. All these parks are connected by boulevards.

The Special Park Commission was created by the city in 1899 for the purpose of the development of a systematic and concerted plan for meeting the city's needs in the matter of breathing spaces of various sorts, including small parks and

playgrounds for children, and swimming places, public baths, parkways and the like. It has jurisdiction over sixty-five parks, seventeen playgrounds and two bathing beaches, and is constantly adding to its park acreage.

The parks are all beautifully wooded, with walks, drives, bodies of water for boating, bathing beaches, recreation facilities, flower gardens and athletic and picnic grounds. The smaller parks and playgrounds are equipped with play apparatus, shelters, sand courts, athletic fields, wading pools, running tracks and baseball diamonds, and in winter tobogganing and skating facilities are provided. Garfield park has the largest conservatory in the country, Lincoln park has one of the largest zoological collections in the country, and other parks have golf links, baseball grounds, tennis courts and other facilities for recreation and games.

Ten years ago a great Frenchman, visiting Chicago, made the statement that "Chicago had not yet discovered its lake front," and that was almost literally true at that time; but within the last few years the people have begun to exhibit a great yearning for the shore waters of our beautiful inland, unsalted sea. Take the entrance to Lincoln park, at the corner of North avenue and Clark street, for instance. The street cars there deposit on holidays, Saturdays and Sundays forty to fifty thousand people, largely from the city's West Side. Why? Because the people want and need the fresh and invigorating air nature intended they should have, because people generally love water. Chicago's location on Lake Michigan is unrivalled among the great cities of the world. A visit to Lincoln park on almost any hot day in summer affords convincing evidence that the people of Chicago have "discovered the lake front." Six thousand people in a single day have availed themselves of the bathing privileges afforded by the Lincoln park free bathing beach. It is not uncommon, as early as 9 o'clock in the morning, to see two hundred or more men, women and children standing in line at the entrance of the bath house waiting for accommodations.

The Chicago Plan Commission, to which the city of Chicago committed the plan of Chicago, originated by the Commercial Club of Chicago, has not been slow to realize the necessities engendered by modern day city life, and, in co-operation with the plan committee of the Commercial Club, of which Mr. Edward B. Butler, one of Chicago's leading public-spirited citizens, is chairman, bent its initial energies toward the carrying out of one of the greatest and most spectacular features of the plan of Chicago—the development of the south shore of the city's lake front.

This is one of the three great elements which make up the park plans of the future city under the plan of Chicago. The lake front to the south is to be improved, beautified and put at the service of the city's millions for the creation and preservation of public health. The central idea of the lake front park scheme is a plan for parks in Lake Michigan, reaching from Jackson park on the south to Wilmette on the north, a stretch of twenty miles of water front parks. These are not to be boulevarded for vehicles, but real parks and playgrounds for all the people, where family picnics, tennis and all manner of outdoor sports may be freely indulged in.

Beginning at Grant park, at the center of the city, the plans provide for the filling in, first, of a wide strip of shore land facing the open lake, this strip to extend solidly to connect with Jackson park on the south. The strip is to be planted with trees and given informal landscape treatment with flowers and shrubs, growing throughout its extent. Along this shore will run the water course for small crafts, for sailboats, motor boats, canoes and racing shells. Beyond the water course, built to protect it and provide safety and shelter forever of pleasure craft, will be a long island park, planted with trees, having winding walks and driveways, and providing frequent bathing beaches for the city's summer multitudes.

The development of the south shore of Chicago's lake front, as planned, in conjunction with that already completed, will give the city eleven miles of the most imposing water front of any city in the world. The work, however, will not stop there, but will be continued until thirty-five miles of the city's lake front have been developed as a park and put at the service of all the people. Thruout this magnificent stretch of lake front parks there will be frequent ways of access to the islands. Every half mile, perhaps, there will be a wide bridge, arching gracefully across the lagoons and waterways, inviting the people to recreation and rest upon the cool, airy, tree-shaded islands. There will be unlimited relief from the summer's heat for the city's millions and the citys' guests, and in winter unlimited enjoyment of all outdoor sports upon the frozen surfaces of the lake waterways.

The second element in park development proposed by the Chicago Park Commission, in accordance with the plan of Chicago, aims to create new parks upon a scale in accordance with the needs of the city, and, after a fashion, to express the size, wealth and importance of Chicago. Considering the shape of the city, the location of the great body of its citizens, the direction of future growth, the manner of laying out the streets and boulevards, and all other conditions affecting park plans, it was decided that the plan of Chicago

should provide three large city parks. There is to be one in each section of the city, and the plan is to connect the three by a boulevard, which in its scope and character will give the Chicago park system world-wide distinction.

Next in importance to the lake front development we may, perhaps, give place to the matter of securing for the people of Chicago large areas of forest lands adjacent to the city. These should be in their natural condition, filled with such wild trees, shrubs, vines and flowers as grow in this climate, and the people should have free access to them all for all time. Five sites have been designated in the plan of Chicago, which were selected with a view to getting the best lands for such purposes, the most attractive natural sites, and all readily accessible and near to all the people of Chicago.

Modern cities have learned that they must not confine their park land projects to their own limits, but must go beyond them and out into the open country to provide recreation areas for their people. Every European capital has its forest preserves or parks outside of its limits, but within easy reach of its people. Thus in summer, London, Paris, Berlin, Vienna and other cities are, on Sunday, deserted by their millions, the people dispersing to the open country park lands and the forests set aside for their use and enjoyment forever. In this country other cities are acquiring outer territory for park purposes, notably New York in its acquirement of the picturesque country along the Hudson river, and Boston in its acquirement of the forest preserve territory under the jurisdiction of the Metropolitan Park Commission.

In the plan of Chicago provision has been made for extending the existing park areas within the city, that wholesome and necessary recreation may be close at hand for all the people in all parts of the great future city. In addition provision has also been made for wide areas of forest and stream outside of the corporate limits, but upon the borders of the city, to be acquired and held in their natural state as places where the city-worn worker and his family may rest and wander freely in holidays and vacation time.

Nature has given Chicago the possibility of creating an outer park area entirely surrounding the city and immediately adjacent thereto. Glencoe, to the north of Chicago, lies in the center of a broken territory which affords a natural park entrance to the country from the lake shore. Piercing the country to the westward there is the Skokie marshland, almost as beautiful as the lake itself. A mile inland is the valley of the north branch of the Chicago river, where the ever-changing views give never-ending delights. Southward the forests extend along the river down toward and approaching the city limits, and comprise about eight thousand acres which should be taken for this great natural northern park. Extending westward from Glencoe is the proposed Desplaines river reserve, passing down that valley to Riverside. To the west lies the proposed Elmhurst and Salt creek reserve, including the valleys of Salt and Flag creeks, a country of great natural beauty. Mount Forest, the fourth proposed reserve, lies in a southwesterly direction, and includes the fine rolling country and forests in the Willow Springs district. Eastward from this reserve is the fifth proposed reserve, the Lake Calumet, including the region surrounding that body of water and the Calumet feeder, Stony creek and the little Calumet river.

The voters of Cook county in 1910 gave their consent to the creation of a Cook County Forest Preserve Commission, in accordance with the provision for the creation of forest preserve districts within counties in Illinois, which was authorized by the General Assembly of Illinois in 1909. Unfortunately, however, this favorable action was nullified by a legal technicality, and the Chicago Plan Commission, the Commercial Club plan committee and other interested bodies are at work to secure new legislation which will enable the city to secure the proposed areas without undue delay. An ordinance has been introduced in the Chicago city council looking toward the securing of the necessary state legislation, and the acquirement of the forest preserve territory outlined in the plan of Chicago and advocated by the Chicago Plan Commission should be secured at no distant date.

The present and proposed park and forest preserve area for Chicago, as contemplated in the plan of Chicago, and advocated by the Chicago Plan Commission, is 50,000 acres. Social experts all agree that there should be one acre of park space to every one hundred inhabitants of a city. Berlin is the only large city in the world which at the present time exactly measures up to that standard, with 3,500,000 population and 35,000 acres of parks. The park plans of Chicago will be ample to meet this standard for the next seventy-five years.

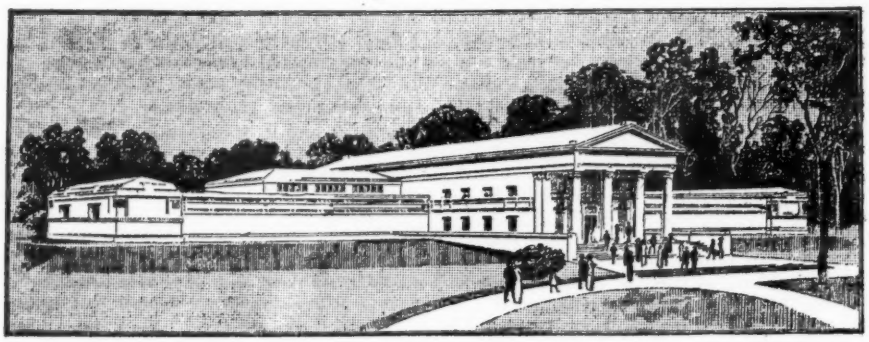
Steel-Taped Cables for Underground Wires

Success in present-day engineering is measured not alone by strength and efficiency, for beauty is at last recognized as a most essential element of the accepted design. Bridges and structures, heretofore deemed satisfactory if strong and serviceable, now create a storm of protest

if the element of beauty is lacking. Likewise the appearance of streets and boulevards is receiving a share of that attention which was formerly devoted to convenience and durability. Only a few years ago our cities were in a maze of overhead wiring, but now the wires have been placed under ground in the larger communities; the smaller places, however, have been seriously hampered in their efforts to follow this praiseworthy practice, because of the considerable cost of conduits for underground systems. With the advent of steel-taped cable the way has been cleared for further progress along this line. Briefly, the steel-taped cable provides an adequate substitute for the underground conduit system at a much lower cost. Its purpose is not to displace underground conductors in ducts where a permanent, flexible system and provision for suitable future growth is necessary, but rather to fill a particular need for which the conduit system is neither adapted nor required. This field includes the smaller cities, suburban districts, parks, private estates and manufacturing plants, and where local conditions do not justify the expense of a conduit system and flexibility is unnecessary. Western cities are considerably in advance in the installation of such underground systems. Lansing, Mich., St. Charles, Ill., Wausau, Wis., Austin, Tex., and Warren, Ohio, are among those which have used steel-taped cable in their ornamental street lighting systems. Kendallville, Ind., and Henderson, Ky., have employed it in connection with the decorative lighting of their public parks. These cities have used a regular lead-covered cable served with jute and tar, over which are two winds of steel tape in reverse directions with still an overall serving of jute and tar. The experience of these cities has shown a material saving in initial cost, due not only to the cost of the cable itself, but to the difference in the time and labor of constructing a conduit system and drawing in the regular lead-covered cable in the ducts over the installation of the steel-taped cable. While plans and expert superintendence are essential in the construction of a conduit system, the steel-taped cable is laid in a narrow, shallow trench and the earth replaced. The service record of this ready-made cable-conduit system has been so satisfactory as to give assurance of its success in the work for which it has been adopted.

The Municipal Mausoleum

The City Beautiful idea is extending to the problem of the cemetery. Municipal mausoleums offer a solution, especially for the larger cities. These structures, designed by the most expert architectural engineers, not only offer a practical method of displacing the cemetery, but at the same time may add greatly to the beauty of the municipality.



"ROSEHILL THE BEAUTIFUL," PROPOSED MAUSOLEUM, CHICAGO.

The community mausoleum, shown in the accompanying perspective drawing, represents this municipal mausoleum in embryo. It will be erected within the gates of "Rosehill the Beautiful," Chicago, at a cost of $300,000. Nothing so elaborate in workmanship and design, or so suitable, has before been attempted in America. It will be erected by the Community Mausoleum Company, of granite, bronze, marble, glass, concrete and iron, so as to make it practically indestructible by the elements.

The center of the building will be a large chapel, beautifully finished in marble and bronze, always freely at the disposal of patrons, providing a place for holding services with comfort and seclusion. Perhaps the most important feature is the complete system of ventilation and dessiccation provided. The crypts are hermetically sealed and faced with marble.

WATER WORKS

Hamilton, Ont., Has Trouble with Water Works Intake Construction

BY HUGH L. HUMPHREY, HAMILTON, ONT.

The city of Hamilton, Canada, is meeting with engineering difficulties to an almost countless number in the reconstruction of its general water works system. A year ago the civic administration, after putting the question to the people, appropriated nearly $1,000,000 for improvements and extensions, these to include new intake and crib, several new stations, a force main to cost $300,000, as well as new conduits, submains, etc. Plans were prepared, bids called for, and late last year most of the work was under way, all to be finished this year, the tenders being let in such a way as to spread the work over as many contractors as possible.

Trouble commenced early in the spring, when the rain came down in torrents for weeks at a time. The work on the two new pumping stations had to be abandoned for a month, which threw back a large portion of the other improvements. Great difficulty was also experienced in handling the new four-foot force main, which covers a distance of eight or nine miles. The workmen were unable to handle the big pipe until the city purchased a miniature railway, which it did at a large cost. This big pipe is being laid into the city now, and is the largest water main in this section of the country. Connection with the older part of the city's water service was made a few days ago, and proved an occasion of much anxiety to the city engineers. The sudden and increased pressure caused serious breaks in various parts of the city, which took days to repair. This resulted in the city being with almost no water pressure for several days, and caused a general protest from the insurance underwriters, who threatened the city with increased rates.

Hamilton's chief trouble at the present time, however, is in connection with the big intake pipe she is laying nearly a mile into Lake Ontario. Last summer the contract for this was let to John Danforth & Co., of Buffalo, the agreement calling for the pipe to be laid this year by the 15th of October. The pipe cost $60,000, and for laying it the Danforth people were to receive $31,000. Not only was the big pipe to be supported by piles, but was to have a covering of cement from the filtering basins to the lake shore, a distance of nine hundred feet. Although the Danforth company is under heavy bonds and forfeits $10 a day until the work is finished, only one length of the pipe has been laid, and that has to be redug, so as to concrete around it.

At a special investigation ordered by Hamilton's city council, the representatives of the Danforth company flatly admitted that they had been unable to do much work during the whole summer, in fact, said that they had spent $20,000 in preparing to lay the pipe, and now had only one length laid. The secretary of the company appeared before the Board of Control and told them that the work would be finished at any cost, as the company's reputation was at stake, and asked to be given until next summer to finish the contract. This City Engineer Macallum was against, but after much discussion the controllers agreed to give until next August to have the pipe laid and finished in all particulars. The company is under a $10,000 bond to do this, and still forfeits $10 a day.

There is no doubt that the Danforth people took on a greater proposition than they had any idea of when they agreed to lay Hamilton's pipe. This has to go out into Lake Ontario from a spot where there is absolutely no harbor or shelter for the workmen, and because of the lack of this knowledge the Buffalo concern is out about $20,000, with the intake still to be laid. Six distinct attempts were made to lay the pipe, the men working night and day in preparation, but on each occasion a storm would blow up and destroy all the supports, the wind carrying the wooden structures for miles along the lake shore, and in one instance carrying the pipe far out of its course. The main trouble seems to be that the company spent all summer spending thousands of dollars to lay the pipe, and left the actual work of laying until too late. This, however, has not been the only setback the

Buffalo concern has been forced to bear. Its representatives are being forced to pay twice as much for labor as others are doing, this principally because the work is on the lake shore and is an unpleasant job at the best. Ordinary laborers are being paid $6 a day, while teams demand $12, and it is because of this state of affairs that City Engineer Macallum figures that the Danforth company will be out many thousands of dollars on its contract.

The situation at the present time is that the council has agreed to give the Danforth concern until next August to finish up the work, and if it is not done then steps will be taken to collect the $10,000 in bonds the city holds and also the $10 per day forfeiture. The civic authorities believe that next year they will have to call for new tenders, despite the assurances of the Buffalo company's representatives that every effort will be made as soon as possible in the spring to rush the work to completion.

Danforth & Co. are also building the cement conduit between the basins and the pump house. Their contract calls for $30,000, and there is little doubt that they will finish this job all right and make a reasonable profit therefrom.

Hamilton has many other big waterworks projects on hand, and at the present time the city engineer, A. F. Macallum, is being assisted by two experts from Toronto in drawing up plans for a general overflow sewer system. It is estimated that this will cost between $500,000 and $750,000. Work will commence as soon as tenders can be prepared and let.

Lighting for Small Towns and Villages

The problem of efficient illumination for small towns and villages has attracted a great deal of attention, and has seldom been worked out with entire satisfaction. While gas has ordinarily been used, it has been difficult to obtain a design of plant which would produce a gas suitable for both illuminating and heating or cooking, and which at the same time could be operated at a sufficiently low cost to make such a plant efficient. Several reports have been received from owners of plants installed by the Practical Gas Engine and Machine Works Company of North Chicago, which indicate entire satisfaction with this type of plant. The "Practical Gas Plant" seems to provide the ideal process by which gas can be economically manufactured for use in towns and villages having less than three thousand inhabitants. These machines cost, installed, from $1,500 to $3,500, depending upon the capacity. This cost is exclusive of buildings and mains.

In a number of instances private plants have been installed and a part of the product sold to neighboring residents. In such cases an earning of from eight to ten per cent. on the investment has been an easy matter. These plants require only a part of the time of a single operator, and the maintenance cost is practically negligible.

A. A. Herzog, of Harvard, Neb., writes that he produces eighty-two thousand cubic feet of gas from two hundred gallons of gasoline. From this gas he receives a gross revenue of $123, while the gasoline costs approximately $40, leaving a gross profit of $83 on this small plant.

The Practical Gas Engine and Machine Works have built and installed one hundred and sixty of these plants, many of which are owned by small towns in which a marshal looks after them as a part of his regular duties.

The gas used in this system is manufactured by a machine which unites under pressure 87 per cent. of gasoline and 13 per cent. of air. The mixture thus produced is claimed to have 35 per cent. more heat than is made from oil or coal. The manufacture of gas from gasoline is, of course, nothing new or untried. In most cities and villages gasoline lamps are being used in some form, and the principle is alike in all cases.

With the "Practical Alternating and Cold Process System" it is said that a better light is furnished than by the ordinary gravity pressure often seen in individual stores and houses, for the reason that the mixture of gas and air is made more scientifically and because of the steady pressure which the system furnishes. The Practical Cold Process plants are made in three sizes—600, 1,200 and 1,800 lights, each light of 70 candle power.

Autos for Police Captains and Lieutenants in St. Louis

Eact of the fourteen police district om St. Louis has been supplied with an automobile runabout to be used by police captains and lieutenants in touring their territory. The machines are small two-seated Ford cars, especially constructed for speed and equipped with gongs similar to the automatic bells in use on many modern makes of fire apparatus.

Heretofore when it was necessary for captains or night lieutenants to go out into their districts it was necessary for them to use street cars. Automobiles maintained in all but the mounted districts for the use of detectives in emergencies have neevr been made accessible to commanding officers of the districts.

STREET LIGHTING

Street Lighting in St. Joseph, Mo.

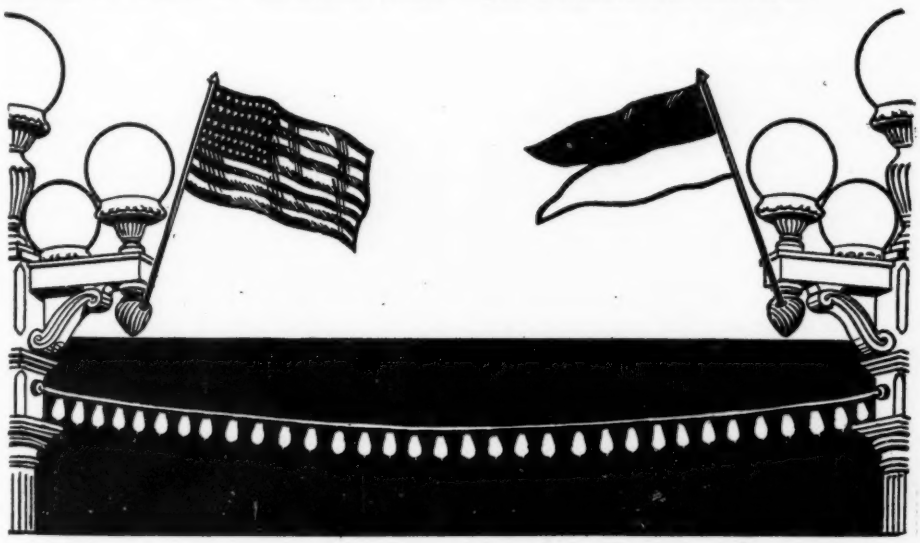
The city of St. Joseph, Mo., is acknowledged to be one of the best illuminated cities of its size in the country.

The city pays for the laying of cable and conduits in the business district, the St. Joseph Railway, Light, Heat and Power Company assumes all cost of ornamental poles and wiring, and the consumer pays a flat rate for the current.

The contract between the lighting company and the consumer reads as follows:

"The company agrees to install and operate a system of ornamental street lighting to consist of ornamental standards placed eight to a block (four on each side of the street), each standard to be equipped with five 60-watt and five 25-watt tungsten lamps. The company further agrees to maintain said standards during the life of this contract (five years). The consumer agrees to pay for such service $.... per front foot per year for a period of five years (or during his tenancy for a period not exceeding five years). My (our) proportionate share, based on a frontage of .... feet, to be $.... per year, payable quarterly in advance. Payments to be made on or before ten days from date of bill. The hours of service of said ornamental street lighting to be from dusk to 12 p. m., and one lamp in the top globe of each post burning from dusk until sunrise. This contract to take effect when electric power shall have been turned on in said lamp posts."

Two hundred "King De Lux" ornamental standards, No. 105, made by the King Foundry Company, of St. Joseph, are in operation. The standards average 1,100 pounds in weight and are made of special blended iron and steel.

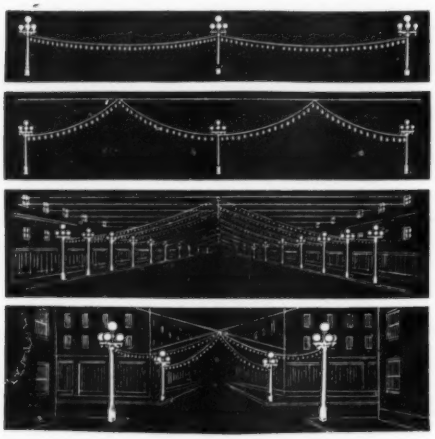


Ornomental Poles, Showing Sockets for Flags and Plugs for Festoons.

These standards have festive illumination connections and flag display stands.

These standards are made according to the King unit or sectional system. This sectional system idea applies to the entire equipment, but is particularly valuable as regards the arms, side and top lamps, and their accessory ornaments. By simple changes and additions the

same column can be altered from a one-light to a two, three, four or five-light cluster. Moreover, the four and five-light standards can be arranged either in the ordinary way with the four horizontal arms, or with only two arms carrying both upright and pendant lamps, all in the same plane. This makes possible the use of harmonious equipment throughout



Decorative Effects Obtainable Through Special Socket Attachment.

a city, and also permits the ready addition of more lamps to each standard as the importance of the street or the appropriation available increases.

This highly desirable flexibility is brought about by the employment of all standard parts accurately made to be entirely interchangeable. In each case the lamps on the side arms may be made upright or pendant, or subsequently reversed, if desired. Several designs of ornamentation are also available for the arms and brackets. All the designs are carefully proportioned to produce graceful effects and to give the appearance of solidity. The equipment is made of iron and steel of great strength.

The dimensions of the King De Lux standard adopted by the city of St. Joseph are as follows:

Height (to top of center globe), 14 feet 3 inches.

Base, 20 inches square.
Diameter of column at bottom, 8 inches.
Diameter of column at top, 7 inches.
Side globe fitters, 6 inches.
Top globe fitters, 8 inches.
Spread of arms, 44 inches.
Weight, 1000 pounds.

The socket connections save all expense of special wiring for festive occasions. The accompanying illustrations show illumination possibilities secured through this special feature. The city of St. Joseph can speedily and economically assume a festive street dress during holiday or carnival seasons, as well as bid welcome to conventions and celebrations of any description. The flag holders permit of the showing of national colors and insignia where they will loom up in conspicuous fashion either by night or by day.

"The globe breakage through wind, hail and jars by teams is exceedingly small," states F. C. Pullen, of the St. Joseph Railway, Light, Heat and Power Company. "We use five 60 or five 25-watt Mazda lamps per post. The average cost of maintenance per post is $5 per year. The consumer pays a flat rate of $1.15 per front foot of premises per year.

"The column proper contains about ¾-inch metal, while the arms, lamp bowls and ornamental castings on top of post contain about ⅜-inch metal.

"All of the ornamental castings on top of posts are well secured with stove or machine bolts, and well fitted together in such a way as to prevent water from getting inside the post. The bowls for holding the globes have a trap which will readily drain the water to the outside. The bowls are also fitted with brass screws, ready to receive the globes, each containing three screws.

THE WHITE WAY " IN SAINT JOSEPH.

ORGANIZATIONS & INDIVIDUALS

System of Passenger Subways for City of Chicago Urged by Harbor and Subway Commission

John Ericson, consulting engineer of the City of Chicago, is chairman of the Chicago Harbor and Subway Commission, which recently reported that: "Genuine rapid transit in Chicago is impossible without a comprehensive system of municipally-owned passenger subways radiating to outlying sections of the city." This commission has issued a supplemental report, showing needs and profits in a bore system.

The engineers' defend their estimates of operating and construction costs with figures from the experience of other cities, and assert that profits would be certain.

"It would be impossible to have two distinct financial schemes, one for the surface lines and one for the elevated," says the report. "If this plan were followed the results would be an agreed valuation of the elevated roads. To this should be added the cost of making each of the roads a four-track structure and the cost of additional terminals, new rolling stock, and additional electrical power and equipment.

"Taking the value of these roads as represented by the elevated companies—$93,000,000—the necessary additions would be at least $40,000,000, making a total of $133,000,000.

"The purchase price of the surface lines February 1, 1912, was $127,500,000. This would make a total of $260,000,000 to start with, on which the companies would be allowed 5 per cent., or $13,000,000. The operating expense for 1911 for surface lines was $19,473,571, for the elevated line in 1910, $5,810,128, a total of $25,283,699, making a total for interest and operating expenses of $38,283,699. To this should be added interest on cost of downtown subway—5 per cent. on $10,000,000, or $500,000.

"The total receipts were about $37,900,000, or over $300,000 less than the amount required on the purchase price. In other words, the cost to the city would be the 55 per cent. it is now receiving from the surface companies. It would be simply turning the 55 per cent. traction fund over to the elevated roads to pay interest on a fictitious valuation."

Technical Associations

The American Institute of Architects has re-elected Walter Cook, of Newport, as president. The president and the Institute express themselves in no uncertain terms regarding the loss to the nation in artistic value of buildings and in their cost by the repeal of the Tarsney act, which now places the design of all public buildings in the office of the supervising architect.

The Indiana Good Roads Association held a three-days' "Better Roads Congress" in Indianapolis, December 11, 12, 13, at which almost 800 persons registered and gave the cause of good roads a decided impetus. The convention adopted resolutions which, among other things, declared in favor of a state highway commission, the classification of roads as state, county and township, the former to be exclusively in charge of the state commission; a state highway fund raised by taxation and vehicle license taxes, payment of all road taxes in cash, abolishment of road supervisor's office, protection of highways and the public safety thereon.

The American Society of Agricultural Engineers held its annual convention in Chicago, December 26-28. An important subject for discussion was the draft of specifications for a contest of gas tractors for farm purposes, which would be suited to conditions in the United States.

The New York Electrical Society, on December 19, made a special inspection of the new Grand Central Terminal passenger station at 42d street, which will be opened to the public in January.

Purdue University, Lafayette, Ind., will hold a conference of county surveyors, city engineers, county commissioners and other public officials for two weeks, between January 6 and January 18, with lectures and conferences on hydraulics, concrete, bridges, highways, accounting, specifications, sanitation, etc., in two divisions, one for two weeks for the engi-

neers and surveyors, and the other for one week for other public officials.

At its December meeting the Colorado Association of Members of the American Society of Civil Engineers discussed bills for licensing engineers, for a state public utilities commission, and for a state irrigation court.

A program of 26 papers on highway engineering has been prepared for Section D of the American Association for the Advancement of Science, which meets in Cleveland, O., January 3. Bonds, bridges, repairs, brick, bituminous, small stone block, patented, Topeka bituminous, bituminous gravel pavements, organization, traffic census, road surveying, analysis of materials, handling of materials, methods of testing, maintenance and construction, are some of the subjects treated by state highway commissioners, professors, city engineers, engineers of paving and material companies, chemists, and others who are experts in the field.

The goods roads congress held by the American Road Builders' Association in Cincinnati, December 2 to 6, was one of the most successful road meetings that has been held in character of program, in quality of exhibits and in interest manifested. The addresses and discussions were almost entirely devoted to problems of construction and maintenance, and as the speakers were mainly those who are in the control of the best work that is done, they were more than usually valuable. The stores of material offered will be drawn upon from time to time as opportunity offers.

The San Francisco Exposition

The Panama-Pacific International Exposition buildings are under way, one approaching completion, one beginning in January, and parks and sites are being cleared and planted. Eighteen states have selected sites for buildings, and 21 foreign nations have announced participation.

Canadian Mayors Elected

Mayors of cities in Canada have been eletced for 1913 as follows: Calgary, H. A. Sinnott; Edmonton, Wm. Short; Lethbridge, W. D. L. Hardie; Moose Jew, Jas. Pascoe; Prince Albert, N. W. Morton; Regina, Mr. Martin; Saskatoon, E. F. Harrison; Winnipeg, T. R. Deacon.

Personal Notes

Alexander Potter, consulting and constructing engineer in hydraulics, sanitation and reinforced concrete, has moved his offices to No. 50 Church street, across Liberty street from his former location.

Mr. H. A. Paine, Assoc. M. Am. Soc. C. E., for seventeen years identified in railroad location and construction throughout the United States, and for the past four and a half years road engineer for Caroline county, Maryland, has resigned his commission, to take effect March 1, 1913. Address Denton, Md., until March 1, 1913.

Miss J. Arminson MacIntyre, for over ten years manager of the publicity department of the C. W. Hunt Company, West New Brighton, N. Y., is resigning that position early in the new year. While no definite plans have been made for the future, it is understood that Miss MasIntyre will travel for a time. Communications should be addressed care of the National Arts Club, New York City.

John G. Berquist, works manager of the Universal Portland Cement Co., has resigned that position, and will hereafter act in the capacity of consulting engineer. Leonard Wesson, superintendent, Plant No. 2, South Chicago, Ill., has been transferred to the general office of the company to assist President Edward M. Hagar in matters relating to appropriations, construction and operation. Mr. Wesson will have the title of assistant to president. Nels Nelson, who has been assistant superintendent of Plant No. 2, has been promoted to the position of superintendent of that plant.

Arthur H. Blanchard, M. Am. Soc. C. E., professor of highway engineering in Columbia University, on November 25th, delivered an address entitled "The Art and Science of Highway Engineering," at the celebration of Founders' Day at the Clarkson School of Technology.

C. B. Smith, formerly associated with the Atlas Dryer Company, of Cleveland, Ohio, has developed a new system of dryers which he is now placing on the market under the firm name of C. B. Smith & Co., 411 Prospect Hippodrome, Cleveland, Ohio. The company has issued a comprehensive catalog, giving full description of the new drying machinery offered.

R. W. Hutchinson, Jr., of the International Motor Company, of New York City, expresses decided and logical reasons opposed to the contemplated regulations restricting the tonnage of motor trucks on state highways. He advocates proper construction of roads to withstand motor truck traffic rather than any restriction upon the size and power of the equipment necessary to meet the demands of the times.

MACHINERY AND TRADE

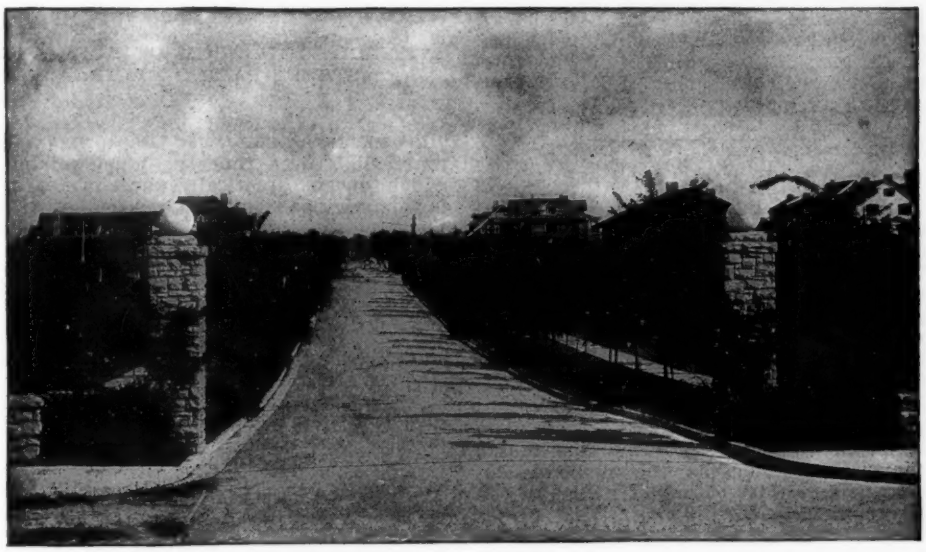
Mineral Rubber Paving in St. Joseph, Mo.

"Good pavements are not only found in our largest cities, but in our smaller ones as well," states Mr. R. M. Davis, president of the Metropolitan Paving Company of St. Joseph, Mo. "We paving contractors of the less important cities have access to the same paving materials as the big city contractor; we have the same machinery at our command, and the taxpayers in our towns are just as particular as in the largest cities.

"Sarcolithic mineral rubber pavements have proven to be exceptionally satisfactory in St. Joseph.

"Our paving in St. Joseph has been the cause of a great deal of favorable comment on the part of visiting municipal engineers. We own our own asphalt plant, which is centrally located, and superintend each and every detail of the laying, because the durability, long life and evenness of wear depends in no small measure upon the care taken in the mixing and laying.

"The ingredients of the aggregate for mineral rubber paving must be thoroughly mixed, to furnish uniformly a minimum percentage of voids. The exact proportions of the aggregate and binder to produce best results must be rigidly maintained by accurate measuring devices.



SACOLITHIC MINERAL RUBBER PAVEMENT, ST. JOSEPH, MO.

"The proportion of automobile owners per thousand inhabitants runs higher in a city of 50,000 than in a city of 500,000, and consequently comparative values of different pavements are very carefully considered. Durability, low maintenance, ease of cleaning, low tractive resistance, freedom from slipperiness, sanitary properties, as well as initial and average annual costs are elements which enter into the situation.

"Our pavements are tough and resilient. They are subject to all kinds of traffic, and are kept thoroughly alive. Their semi-rough or gritty surfaces are a

non-skid footing for automobiles and horses. They do not wear glassy or slippery either during winter or summer.

"This type of pavement is capable of withstanding a range of more than 120 degrees F. variation without displaying any indications of cutting, chipping, contraction or expansion. It is as nearly noiseless as is possible, and the fact that it does not grind into dust is appreciated not only by the property owners, but also by the city, for the reason that sprinkling costs are lessened."

Mr. C. P. Hoff, assistant city engineer of St. Joseph, states: "We have approximately 260,000 square yards of mineral rubber and sheet asphalt paving on our streets, carrying both residence and retail district traffic. In certain parts of the retail district the traffic is exceedingly heavy. These asphalt paved streets compare favorably with other streets paved at the same time with other materials, and we are well pleased not only on account of the noiselessness of our streets, but because the maintenance or up-keep has been comparatively low.

"The total cost to the city for repairing asphalt streets for the fiscal year ending April 15, 1912, was $4,672.75. We clean our asphalt streets by flushing with fire hose. In addition to this, in business districts streets are cleaned by hand brooms and hand scrapers."

Mixing Concrete Base

While care in the selection of good stone and sand and the proper proportion of a standard brand of cement, together with close attention to every detail of the laying, are requisites in the making of the pavement base, engineers cannot pay too much attention to the thoroughness of the mixing and the methods of distributing, else the results be deficient.

No shoe is better than its counter, and no pavement is better than its base. The base must be so carefully constructed that neither time nor the elements can change its ability to properly support the pavement proper.

Proper proportions do not guarantee first-class concrete.

Concrete evenness, solidity and permanency depend primarily upon the manner and thoroughness of mixing.

The Koehring Street Paving Mixer, which we use in our work, has a discharge chute which aids greatly in the proper mixing of concrete for pavement foundations.

In mixing, by the rotation of the drum the buckets cut through the contained material at the bottom and carry portions of it up and pour it from the side. The mixing blades also cut through at the bottom, and carry material up and discharge it alternately from end to end, breaking it over against the heavy heads of the drum. Material carried to sufficient height by both buckets and blades falls on the inwardly extending discharge chute, and flows off the inner end of the chute in a shower or sheet, the entire width of the chute. This action is precisely the same as a body of water dashing downward over rocks.

Since these three independent mixing actions are constant and opposed to one another, there is a continual intermingling of all the material in the drum, and practically three times as much mixing, which means practically three times as fast mixing, as would be possible with any one of these actions alone. The Koehring principle of three independent and opposed actions produces a perfect intermingling of the entire batch, and therefore absolute uniformity of product.

INTERIOR VIEW DRUM OF KOEHRING STREET PAVING MIXER.

Care should always be exercised in the adding of water, because when it is introduced in a flood, as is oftentimes the case, the cement is washed from the mixture. Water should never be added faster than it can be taken up by the materials. This machine is equipped with a water-measuring tank, which supplies the proper amount of water for each batch and applies it as the batch is mixing.

The Koehring machine is especially adapted for street work, as one man tends the machine and, without leaving it, mixes, delivers and practically spreads the concrete every minute in almost one continuous operation. The concrete is conveyed by a large bucket, holding the full contents of the drum, to the end of a long beam—20 to 30 feet in length—and there is automatically dumped and spread while the bucket returns to the drum to repeat the operation. The boom has a universal joint, and conveys the concrete at any angle from side to side.

Etnyre Sprinklers and Flushers

E. D. Etnyre & Co., Oregon, Ill., in connection with a complete line of horse-drawn and motor-driven sprinklers, flushers and road oilers, are now manufacturing a very commendable and efficient motor truck street sprinkler and flusher combined.

These combination motor-driven machines range from 40 h. p. to 50 h. p., and in capacity from 850 to 1,400 gallons. The tanks are built of steel, but wood tanks are furnished if desired. The chassis on Model No. 5, 1,400 gallons capacity, has a frame of 6-inch rolled channel steel weighing 8 pounds per foot. The front axle is of a high-carbon steel, 2¾x2¾ inches, and the rear axle is of a 4-inch round high-carbon steel with Timken roller bearings. The front and rear springs are semi-elliptical. The motor is water-cooled, vertical, four cylinder cast in pairs, four-cycle, with 5-inch bore and stroke. The length of frame, 204¾ inches; the wheel base, 130 inches. The wheels used are of artillery type, with felloes full width of rim. Gasoline capacity is 20 gallons. Equipment includes two side oil lamps, oil tail lamp, horn and full set of tools. Maximum speed is 12.5 miles per hour.

The flushing attachments on Etnyre machines are adjustable, and can be turned in any direction and at any angle to the surface of the street to secure the greatest efficiency.

Any of the different models can be furnished with gravity type of sprinklers only, with pressure type of sprinkler, or in combination with flushing devices. The volume of water can be regulated by the operator as desired to correspond with the speed of the truck; and the pressure sprinkler device controlled to cover any distance from 10 feet to 90 feet. The pressure for flushing is obtained by the use of centrifugal pump, which is direct connected to the truck motors, and pressure is uniform. Any model of the flusher or pressure sprinkler can be equipped with device so that the tank can be filled from canals or streams when desired. It is claimed that the motor truck sprinkler will do the work of 4 to 6 horse-drawn sprinklers.

1. Drawing Water at a Distance of 25 Feet at Rate of 250 to 300 Gallons a Minute.

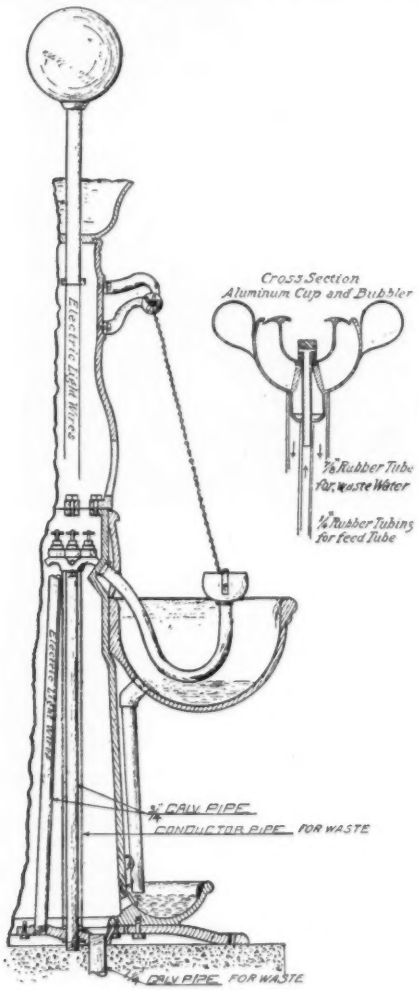
2. Possibilities of Etnyre Street Flushing Machine in Case of Fire.

Sanitary Drinking Fountains

"Along with ornamental lighting standards ranks the ornamental drinking fountain as a means of really practical and useful ornamentation for streets and boulevards, as well as for business districts and parks," states a leading park engineer. "Public drinking fountains, however, should be constructed along strictly hygienic and sanitary lines, for what is not conducive to the health, usefulness or comfort of the individual is worthy of little consideration by the municipal official.

"Several leading municipalities last year installed a large number of drinking fountains in their business districts, and it can truthfully be stated that these fountains were not only not ornamental, but decidedly unsanitary. These same municipalities now realize their mistake. The fountains were so low in height that it was a common occurrence to see dogs drinking from them. The dogs were not

to blame. Fountains to be sanitary should be of sufficient height and the bubblers should be so protected as to be out of their reach. Those fountains with excessive continuous flows are decidedly wasteful and expensive in the long run. A drinking fountain should not only be ornamental, but it should be sanitary, it should have a continuous but not excessive flow in order to keep the bubblers in


Cross Section
Aluminum Cup and Bubbler
Electric Light Wires
⅜" Rubber Tube for Waste Water
¼" Rubber Tubing for Feed Tube
¾" GALV. PIPE
CONDUCTOR PIPE FOR WASTE
¾" GALV. PIPE FOR WASTE

SECTIONAL VIEW OF LANSING FOUNTAIN.

a clean and sanitary condition, it should also contain a special basin near the walk level for dogs and other small animals.

"The public drinking cup has been rightfully condemned, but when the low type bubbler took its place the small child, the woman, the tall and the fat man found they had no place to drink. To the child it is impossible; to the woman it is disgraceful; to the tall man awkward, and to the fat man—well, it can't be done."

The cut shown illustrates the cross section of an improved type of ornamental drinking fountain in which are incorporated several advanced hygienic features worthy of special notice. Briefly, the principal feature of the fountain is in the hose and cup arrangement, which consists of a double tube, the inner tube being the feed pipe and the outer tube carrying away the surplus water while the person is drinking.

The flow of water thru the inner tube is continuous, but not excessive, no matter what the position of the cup. When the cup is lowered the waste water flows over the edge of the cup (keeping it sanitary) into the large bowl. When the cup is raised, this waste water flows thru the outer tube, directly into the drain. This dual system of carrying away the water avoids any dripping or splashing and keeps the cup in sanitary condition at all times. The dog trough at the bottom is fed from the overflow of the large bowl.

The fountain is patented and manufactured by the Gier & Dail Manufacturing Company, of Lansing, Michigan. It has now been in continuous service for about two years, and has shown no indications of freezing, although last winter it was several times subjected to a temperature as low as 25 degrees below zero.

Interlocking Street and Road Signs

An interlocking street and highway direction sign, so constructed that each individual sign becomes a strong and rigid truss, is manufactured by the Matthews Interlocking Sign Company, White Plains, N. Y. The manufacturer has also given especial attention to mountings and supports, and offers a complete line for attaching signs to iron trolley or lighting poles, wooden telegraph poles or buildings, as well as the individual sign poles for setting in concrete or in the ground. The best materials are used throughout, and the several practical tests show remarkable strength and durability. These signs have been extensively used, and have been consistently satisfactory. Prints showing full details of construction can be obtained from the manufacturers upon request.

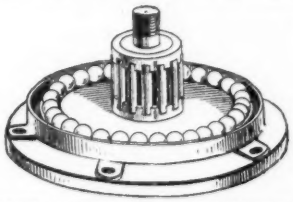
Russell Grader Disc Plow

The Russell Grader Disc Plow, as used on the elevating graders of the Russell Grader Manufacturing Company, takes the place of the common mold board. It will plow through any material, such as fine sand, gravel, soft, sticky soil, old

ditches filled with rubbish and water, and will deliver the material perfectly to the apron and scour clean.

The rotating motion of the disc blade with its cutting edge enables it to handle all material successfully. It is surprisingly effective in sand, gravel and sticky soil; it cuts through dead grass and rubbish, delivering the material to the apron in the most satisfactory manner, and obviating the necessity of clearing the land.

The plow is mounted on ball and roller bearings. The bed-plate casting to the standard is machined true on its inner face, and contains a semi-circular case-hardened ball race in its periphery, in



BALL AND RUBBER BEARINGS IN CASTINGS THAT HOLDS DISC BLADE.

which are carried thirty-two ¾-inch steel ball bearings. All are of the highest grade of material, machined true and adjusted with precision, making the adjustments of the plow bearing as perfect as those of a watch. The bearings run in hard oil and require little attention. The bearing casings are made absolutely dust-proof, and there is therefore no possibility of their being cut out with sand and dirt.

Small Tilting Batch Mixer

Illustrated herewith is a concrete mixer of few parts and well balanced design, as made by the Cement Tile Machinery Company, of Waterloo, Iowa.

This machine is equipped with a 1½ h. p. engine, has a ⅛-yard capacity, and is mounted on a truck 3½ feet in width. Its height over all is 5 feet and its length 6½ feet. The machine is termed the "Contractors' Helper Mixer," as it is especially suited for little odd jobs on large contract work, or for use as an auxiliary machine.

THE "CONTRACTORS' HELPER" MIXER.

The Contractors' Helper is a machine of merit. It is of good size and weighs 1,000 pounds. It is constructed along the very best principles employed in concrete mixing machinery. This mixer has a capacity of one-eighth yard, or from three to four cubic feet, and under ordinary conditions it will mix a batch of concrete every minute, giving it a capacity of from twenty to thirty yards per day.

Costilla Estates Tower

Probably the largest and most unique irrigation project in the United States is the famous San Luis Valley of Colorado, consisting of approximately 548,000 acres, and owned by the Costilla Estates Development Company. The holdings of this company include the southern half of what was originally the old Spanish "Sangre de Christo Grant" in southern Colorado, and extending into New Mexico.

The water necessary for the irrigation of this area is secured from an enormous reservoir, which under normal conditions is about two miles wide and five and one-half miles long. However, during high water the length increases to seventeen and one-half miles.

One of the interesting features of this reservoir is the controlling tower, a large reinforced concrete structure, 150 feet in height, 15 feet inside diameter, walls 3 feet thick at the base and 1 foot at top. The whole is set on a rock foundation with a 25x25-foot reinforced base 12 feet thick.

The walls of the tower were waterproofed with Ceresit compound, which was mixed with the water used in the concrete in the proportion of 12 parts of water to 1 part of Ceresit. The concrete mass was in all cases tempered quite wet. The amount of Ceresit mixed with the gaging water was increased or decreased according to the pressure of the water. Where the water pressure was low, 16 or even 20 parts of water may be used. When the concrete mass was waterproofed, a waterproofed cement mortar was not required, which saved the labor necessary for applying a cement mortar coat, and also the cost of material.

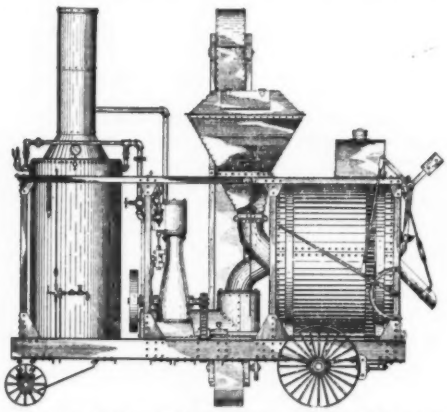
There are eight 30-inch openings in the tower walls at various elevations, placed so that at any stage of water in the reservoir the maximum desired capacity can be taken into the tower through any combination of three openings. On the outside of these 30-inch openings are placed

30-inch sluice gates for general use. These gates are protected from drift, debris and ice by heavy standard 30-inch gate valves for emergency use.

All the stems controlling the twenty valves with which the tower and outlet are provided are run through the floor of the valve house on top of the tower, and are to be under control of the valve watchman at all times. The raising devices are ball-bearing-geared stands of the latest design. The tower was built by the General Concrete Construction of Chicago.

Equitable Asphalt Mixing Plant

The Equitable Asphalt Mixing Plant is being successfully used by several municipalities in melting and remixing old asphalt. When this plant is called upon to produce a load or two of binder, as-



EQUITABLE PORTABLE ASPHALT MIXING PLANT.

phaltic concrete or bitulithic mixture, it is not necessary to make any change whatever in the plant.

After the operation of the plant, if the drums are allowed to run a few minutes the heat thoroughly cleans and drives out all of the material.

The Equitable Asphalt Mixer is of steel construction, and can be built portable or semi-portable with one or more drums, as may be desired. Each drum is 8 feet in diameter and 7 feet long, turning on trunions, and is rotated by a vertical steam engine supplied with steam from a vertical boiler 44 inches in diameter. It has sufficient capacity for running the engine and oil burner, which is supplied with oil from a 300-gallon tank. The material comprising the mixture is charged into the drum in a wet or dry state in their proportions, then a blast of hot air without flame is passed through the drum, which in revolving causes the material to be cascaded through the large volume of hot air, until the moisture is driven from the sand or stone, at the same time causing the asphalt to melt under a temperature of 350 degrees Fahrenheit and adhere to the mineral aggregate, requiring about fifteen minutes to produce a perfect mixture. A very important feature of this process is the fact that the asphalt can be used in its solid state as it comes from the refinery, or, if desired, can be melted before it enters the drum. It requires but a few minutes to heat and mix the asphalt, and as a wagon load is mixed at a time and the sand and asphalt or stone being heated and mixed by the same heating medium, a perfectly uniform mixture is produced, and every batch alike, as it is proportioned while cold.

This plant is mounted on a steel frame having heavy wheels with broad tires, making it easy of traction, and can be drawn with four horses near the work, obviating long hauls. It is exceedingly simple and is very substantially constructed.

The two-drum plant will turn out 1,500 square yards of 2-inch asphaltic top in a day of eight hours. It can be built portable. It will mix binder and asphaltic top at the same time. It will mix any kind of street paving or road-building material without making any change whatever in the plant.

These machines are made by the Equitable Asphalt Maintenance Company, Kansas City, Mo.

The Elevating Grader in Paving Work

The value of the Western elevating grader as an aid, particularly in the grading of streets preparatory to paving, is frequently overlooked by paving contractors. The cost of loading material into wagons, whether it be earth, shale, gravel or macadam, well mixed with small stones, is so insignificant, if compared with the expense of casting the material into wagons by hand work, that not a great quantity of work is required to make a saving equivalent to the original cost of the machine.

The machine can load wagons on a space 18 feet wide, including the room occupied by the wagons, so that it can take earth from the center of streets 36 feet wide from curb to curb, or, if the wagons are permitted to be driven on the parking, much narrower streets can be excavated.

Where all the earth cannot be taken out with the machine, it is generally economical to excavate as large a portion of the material as possible and load it into wagons, plowing up and depositing on

the side of the street the material that cannot be loaded directly into the wagons on account of the lack of width, and taking up this excavated material a second time and loading it into wagons. Even where the material is required to be handled twice, the cost of doing so is far below that for hand work.

The Western elevating grader, manufactured by the Western Wheeled Scraper Company, Aurora, Ill., is made in three sizes. The Junior, the smallest size, has frame 4 feet 6 inches wide by 13 feet 1 inch long; track, 6 feet 1 inch from center to center of wheels; equipped with 18-foot elevator, which can be shortened to 15 feet by removing one section. It will not carry an elevator longer than 18 feet without counterbalance, on account of the narrow base. The Junior is adapted for loading wagons, working in narrow cuts and turnpiking, or for other use where a narrow machine and short elevator are needed. The material used in the Junior machine is the same weight as that in the Standard, and the plow has the same capacity. Weight, about 8,600 pounds.

The Standard is the most popular size on account of its adaptability to general work. The frame is 6 feet 6 inches wide and 14 feet long; track, 8 feet 1 inch; furnished with elevator to make 15-foot, 18-foot and 21-foot lengths. On special order this machine can be supplied with 24-foot elevator, charge being made for this additional length of elevator. The Standard is equally good for ditch work as for loading wagons, turnpiking, building embankments, etc. Weight, about 9,400 pounds.

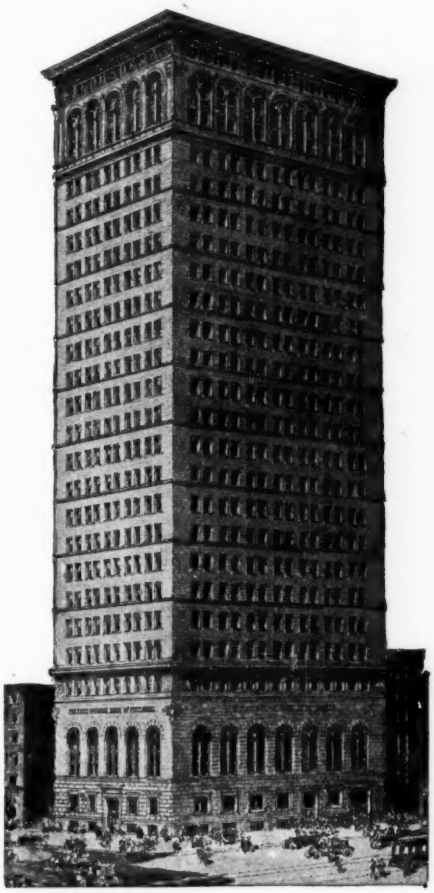
The Giant is a special machine which has been designed to meet the requirements for a longer elevator. It will convey earth a distance of 30 feet from the plow, the elevator being made in sections to operate, 18, 21, 24, 27 and 30-foot lengths. The frame of the machine is 7 feet 6 inches wide by 14 feet 6 inches long; track, 9 feet 1 inch. The Giant is necessarily of heavier construction throughout than either the Junior or Standard machine. It will excavate a ditch over 50 feet wide on top and to a maximum depth of 7 feet. Weight. about 12,000 pounds.

How Modern 26-Story Office Building in Pittsburgh, Pa., Solved Its Smoke Stack Problem

The First National Bank Building of Pittsburgh, Pa., is located on one of the Smoky City's best business corners, is twenty-six stories in height, and of the latest and most improved type of modern fireproof construction throughout. The accompanying illustration shows this building. The first five stories of the exterior are constructed of gray granite, and the remaining twenty-one of terra cotta of a corresponding color. The interior finish is of the finest mahogany; the corridors are finished in white Italian marble; and the floors are of Tennessee marble.

The smoke stack, rising 400 feet in the air, is lined throughout with 2-inch J-M Vitribestos, manufactured by the H. W. Johns-Manville Co., presenting a solid interior surface impervious to gases, fumes and acids of combustion, protecting the metal stacks and insulating them from great heat.

Many smoke stacks are lined with radial brick about 5 inches thick, weighing 100 to 150 pounds per cubic foot. Large slabs of J-M Vitribestos, 3 feet by 6 feet, of 2-inch thickness, weigh, with all attachments, only 30 pounds per cubic foot in place, or about 5 pounds per square foot of stack area.



FIRST NATIONAL BANK BUILDING, PITTSBURGH.

"Indestructible Drilled-In" Signs

"A sign that will last a century" is the name applied to unique and attractive street and road signs manufactured by the Indestructible Sign Company, 101 South Scioto street, Columbus, Ohio.

The accompanying illustration is an accurate reproduction of the sign as it appears when mounted and in use. It is made of solid ingot iron. The letters are drilled into ⅛-inch steel and are sunk 3-32 deep. The surface is of a brilliant black, being part of the material itself and not put on, as in ordinary signs. The entire sign is subjected to a rust-proof process, and the deep sunken letters are then filled with pure white cement. The white concave surface acting as a reflecting mirror, makes this sign perfectly legible at a greater distance than the ordinary flat-letter sign.

There is no enamel or paint to wear away, or rust to make the sign dim and unsightly. Signs of this character are made for any purpose whatever, varying in size from 2 in. x 2 in. up to 12 in. x 48 in., from steel, ingot iron, brass, copper, wood or any other material that can be drilled.

A sample sign will be sent upon request by the manufacturers to any one interested.

Construction of Two Types of Elevated Concrete Tanks

The Editor of MUNICIPAL ENGINEERING:

Although elevated tanks were the first important reinforced concrete structures ever constructed, and although there are some railroad tanks still in existence which were built over fifty years ago, the construction of elevated concrete tanks is still a novelty.

They have a great many advantages over steel tanks, especially in the northern climates, where the thick tank walls of the concrete tanks prevent to a certain extent the formation of ice, which under unfavorable conditions often attains a thickness of 5 feet or more.

Concrete tanks do not need any painting, thereby saving the expenditure of several hundred dollars every few years.

Concrete tanks can be made of monumental character at a very slight additional cost.

In the writer's opinion the reason for the comparatively rare use of concrete for elevated tanks is two-fold:

Firstly, the inexperience of engineers and contractors in designing and building an absolutely water-tight structure. In a reservoir which is placed in the ground wet spots in the walls or even slight leaks are not very objectionable, while in elevated structures they are sources of danger from frost and decidedly unsightly. While wet spots and slight leaks are often overlooked in wooden and steel tanks, they are sources of anxiety in concrete tanks.

Secondly, the cost of concrete structures is, as a rule, very considerably higher than of the steel structures, also on account of the inexperience of designers and contractors.

REINFORCED CONCRETE TANK, CHICAGO, ILL.
For Chicago City Railway Co., 120,000 Gallons Capacity.

The sizes of elevated tanks and their heights are increasing every year, and the cost of the bottom of the tank and its support are by far the greatest items of expense. The ordinary girder and slab construction for the bottom of large tanks is a very expensive affair. Loads of from 1,000 to 3,000 pounds per square foot require very heavy beams and slabs and a great many supports.

There is no more ideal design for tank bottoms than the dome and frustum shape bottom as shown in the illustration.

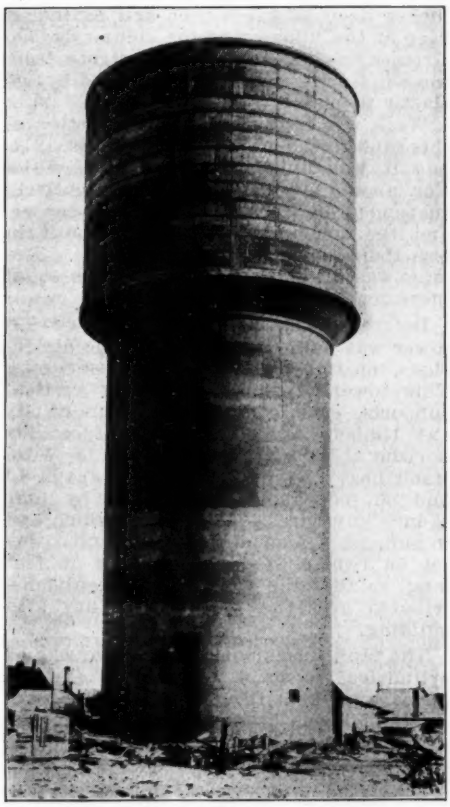
Concrete being an ideal building material for compression, is strained to its best advantage in this type, the inner

dome being only in compression in every direction and the frustum or inverted dome being in compression in one direction and in tension from water pressure in the other direction, at the junction of these two domes may be balanced by the adoption of proper inclinations and sizes of the domes, or there may exist a tension in the ring by the trust of the inner dome being greater than the thrust of the outer dome, or there may exist a compression by the thrust of the outer dome being greater than the inner dome. In most cases there is at this junction a very massive ring of concrete to take care of eventually changing conditions, for the tank empty, for the tank half full, or for the tank filled to its top. This ring may be supported by four or more columns, according to the size of the tank, in which case the ring must serve as a girder and be designed accordingly. On account of the comparatively small spans and great loads, these girders are designed mostly for shear and less for bending, and lend themselves well, thereby, for architectural treatment, as the rational form of such a girder is really an arch on top of the support. Where only four columns are used, this girder is subjected to considerable torsional moment, and must be designed accordingly.

Another way of supporting the ring at the junction of the two domes is to support it on a shell of concrete, or, as it is preferred in Europe, of brick or stone. If the shell is built of brick or stone, it is rarely made less than 18 to 24 inches thick, and although offering opportunity for elegant architectural treatment, it is very much more expensive than reinforced concrete shells, which can be made very much thinner.

A reinforced concrete elevated water tower and tank of the first kind was designed and built last year by the writer for the Chicago City Railway Company as part of a sprinkling system. It has a capacity of 120,000 gallons, although the overflow pipe is placed at the 100,000 gallon level on account of the requirements of the insurance company. A brass coil is placed inside of the tank about 2 feet clear of the bottom to prevent freezing in exceptionally cold weather. The supply and return pipes of the coil are encased in two legs of the supports, as well as two 6-inch riser water pipes.

The design of the tank and tower is shown in Fig. 1. The tower is composed of four legs, each 30x30 inches in section, reinforced as shown. The great spreading of the legs was necessary on account of straddling a dry kiln building over which the tank is built. The structure would have been sightlier if the legs had been spread only 30 feet at the bottom, as originally planned, rather than 45 feet, which it was necessary to adopt. The side wall of the tank is cylindrical in section and 8 inches thick. The roof is a portion of a spherical surface and 4 inches thick, reinforced with ⅝-inch round rods 12 inches on centers in both directions. The construction of the tank bottom is shown in Fig. 1. The inner dome has a spherical surface and is 8 inches thick, reinforced with ⅝-inch round rods 6 inches center to center in both directions. The flaring portion of the bottom, a frustum of a



REINFORCED CONCRETE TANK, BERLIN, ONT.

For City Water Works. Capacity 2,600,000 gallons. Height 125 feet. Diameter 52 feet, outside.

conical surface, forming the outer portion of the bottom of the tank, is also 8 inches thick and reinforced circumferentially with ⅝-inch square bars placed 5 inches on centers.

The ring girder at the junction of the outer dome has at the center a cross section of 24x36 inches, at the columns a cross section of 24x48 inches, and is reinforced. On account of the inclination of the supporting columns, there is a

thrust on the ring girder, which is taken up by two diagonal beams 10x16 inches in section, which are reinforced top and bottom with four ½-inch round bars.

The supporting tower is divided into three equal panels 23 feet 4 inches high, and inasmuch as the dry kiln building prevents the use of any diagonal braces in the tower panels, all the diagonal tension and compression members were omitted and only horizontal struts were provided to bind the columns together and to take care of the wind stresses. These horizontal struts are 15¼ inches wide and 18 inches deep at the center and 48 inches deep at the junction of the columns. The stresses in the columns and struts from the wind pressure were determined by the elastic theory.

Work was begun on the construction of this tank in the middle of November, 1911, and it was finished late in April, 1912. For about 110 days work was entirely suspended on account of the cold weather, and the structure was actually built in less than ten weeks' working time. The tank was filled with water by three equal increments on May 1, 1912.

Before setting up any forms a wooden tower was built, 30x30 feet outside dimensions, of the shape of a Maltese cross. This tower consisted of twenty vertical supports, each composed of four or six 4x4 timbers and thoroughly braced by horizontal and inclined braces to withstand heavy winds, and besides guyed 40 and 60 feet above the ground by four ⅝-inch guy wires. This tower, which had to support a load of 400,000 pounds, was set on twelve 6x16-inch timbers 32 feet long, so that the weight was evenly distributed over the walls of the dry kiln building.

The tank forms consisted of two sets of cylindrical forms 4 feet high. Outside forms were kept from spreading by regular tank hoops by means of these forms, which made it possible to concrete the shell of the tank in one week.

After the tank was completed it was given three coats of plaster, one part cement, one part sand and one-tenth part of hydrated lime. The tank was filled about two weeks after this cement finish was put on the walls and before it was thoroughly set. There appeared a slight sweating at the junction of each day's work, and a slight leak at the bottom of the tank. Neat cement was rubbed on the inside near the places where the sweating appeared, which took a man six hours, and the tank is, as the engineer in charge, Mr. Hugo Smith, superintendent of buildings for the Chicago City Railway Company, declares, "bone dry."

A very much larger tank of the second type was completed by the writer a short time ago for the city of Berlin, Ont. This tank has a capacity of 500,000 im. gallons, equal to 600,000 U. S. gallons. Fig. 2 shows the design of this tank.

The tank is supported by a reinforced concrete shell 12 inches thick and about 80 feet high, resting on a circular foundation 13 feet wide.

The inner and outer domes are proportioned so that the thrusts nearly balance. At the junction of the outer dome and shell of the tank there exists a great outward thrust from the weight of the shell of the tank and of the roof, which necessitated the placing of a large amount of steel, and in order to secure the co-operation of the steel and the concrete there was provided a section of concrete at this junction of 18x30 inches.

The reinforcing of the tank consisted of ⅞-inch and ¾-inch square bars of high carbon steel and placed in two separate layers where the spacing was less than 4 inches. At the junction of the two domes a great excess of concrete was provided to take care of the thrust of the outer dome while the tank was empty or partially full. The reinforcing of the inner dome consisted of ½-inch rods placed from 6 to 8 inches centers, which rods were provided to take care of stresses due to the elastic deformation; otherwise the dome is stressed in both directions in compression only, and would not require any reinforcing.

A mixture of concrete of 1-1-2 or slightly richer was used in all portions of the tank in direct contact with the water. All the other concrete consisted of a mixture of 1-2 and 4.

The lower shell was built by means of wooden forms 6 feet deep, which were suspended from 1-inch rods imbedded in the concrete and 8 feet apart, which 1-inch rods served as a support for a hollow screw, the turning of which moved the forms up. It was found, however, that not more than 4 feet 6 inches could be concreted in one day. The forms for the inner and outer dome were supported on 6x6 Norway pine posts about 10 feet center to center. The forms for the concrete tank were built of twenty sections 3 feet 1 inch high and 8 feet long, and the outside forms were kept from spreading by regular tank hoops. Two sets of these forms were used, one on top of the other, so that one form always served to support the next while being set up.

In order to prevent a leak at the junction of each day's work, due to careless removing of laitance or insufficient tamping of the new concrete, a dam of sheet steel 6 inches wide and No. 28 gauge was imbedded 3 inches in the concrete at the end of each day's work. These dams came in lengths of 82 feet, which is one-half of the circumference of the tank.

The roof forms were supported on 4x4

uprights about 8 feet center to center. As they were 44 feet long they were braced in two directions every 10 feet.

The concrete plant consisted of a chain belt mixer placed near the center of the tank, which discharged the concrete into a hoisting bucket, which bucket ran inside of a wooden tower which was built of four 4x6-inch uprights suitably braced and 140 feet high. This hopper was raised by means of a hoisting engine placed about 50 feet from the center of the tank and outside of the structure. The hoisting bucket discharged the concrete into a hopper which was also placed inside of the hoisting tower, and from here was spouted through a system of pipes and flexible spouts into place. The hoisting tower, placed in the center, necessitated an opening in the bottom and the roof of the tank, which openings were closed and concreted after the rest of the structure was finished.

L. J. MENSCH,
Engineer and Contractor, Chicago, Ill.

Motor Driven Oil Sprayer, Pawtucket, R. I.

The city of Pawtucket, R. I., last year purchased a 3-ton chassis and assembled the necessary appliances for spraying oil on streets under pressure.

To this 3-ton chassis are bolted 4-inch I-beams, and to these a tank of 800 gallons capacity, arranging the dimensions of the tank so that plenty of room would be left for the pressure pump between the tank and the seat. The pump, which is a Deming duplex, is also mounted on I-beams bolted to the frame, and is driven by a belt from the drive shaft. The pump pulley has a clutch, which may be disengaged so that the pump is not running while the car is empty or when full and on the way to the section to be oiled.

When ready to commence oiling, the clutch is engaged and pump starts, taking the oil from the bottom of the tank through a strainer and forced direct to the nozzles under 100 pounds pressure. While turning around to return for applying another strip, the pump is not shut off, and the oil being pumped returns to the tank through a relief valve, the nozzles being closed. The supply from the pump divides into three sections of steam hose, which supply the distributer pipe, which is in three sections, the center having five nozzles and the two outside ones having four each. These are Deming spray nozzles of the kind used for spraying trees. The nozzles are controlled by the parallel ruler motion, being opened by a lever from the seat and closed by a spring, which pulls them to when the lever is released. Everything is controlled from the seat beside the driver except the closing of a section of the distributer for oiling a narrow strip. The tank is equipped with a telltale for filling as the inlet is filled with a screen funnel. This opening is closed with a manhole cover when tank is filled.

The chief recommendations of a sprinkler of this pattern are the facts that the distribution is even, without puddles, and the rapidity of application. In the winter the spraying apparatus has been removed from the chassis and another body substituted, thus making a valuable car for trucking purposes.

During the year this truck has cared for a surface of 835,000 square yards, at a cost of $9,746.06 for oil and labor, making the cost per square yard for the season 1.17 cents. Adding $735.35 for supplies and repairs, makes the total cost per square yard for the season 1.26 cents.

The cost of this automobile sprinkler, complete, was $3,494.28, which, in comparison with others we have seen, is a very low price, while visitors engaged in this line of work proclaim this apparatus the best which has come under their observation.

Trade Notes

The Universal Portland Cement Co. has just issued an unusually attractive calendar for the year 1913. An artistic grouping of photographs demonstrates, very clearly, the varied uses to which Universal cement is adaptable. Such a calendar is an ornament to any office.

The Pittsburgh Testing Laboratory announces that Mr. James Otis Handy, for twenty-three years chief chemist, has been appointed director of research and chemical engineering, and that Mr. Howard H. Craver, for fourteen years assistant chief chemist, has been appointed chief chemist in charge of their laboratories.

Roselle Park, N. J., awarded contract for 15,968 yards of Dolarway pavement to Bamberger & Chapman, Orange, N. J.

For a quarter of a century the general offices and Chicago laboratories of Robert W. Hunt & Co. have been in the Rookery. Owing to the inability to secure in that building the necessary space in which to conduct their very largely increased business, they will move, December 21, to the twenty-second floor of the Insurance Exchange building, Jackson boulevard, between Sherman street and Fifth avenue, where they will have ample space for their offices and both chemical and cement laboratories.

The H. W. Johns-Manville Co. announce the appointment of Mr. C. S. Berry as manager of their Atlanta, Ga., office, located at 31½ South Broad street, where their Atlanta warehouse is also located.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Clinton, Ia.—Jan. 14, 1913, 8 p. m. For furnishing all labor and tools, materials necessary for grading to the established grade, curbing and guttering with cement, concrete combined curb and gutter; for draining and paving with vitrified block on a 6-in. base and 1½ in. sand cushion or for grading to the established grade for curbing and guttering cement concrete combined curb and gutter and vitrified block between and 1 ft. outside of street car tracks and paving with cement concrete consisting of 6 in. base and 2 in. wearing surface. Approximate quantities follow: 11,166 square yards vitrified block pavement, 10,878 lin. ft., combined curb and gutter, 5 catch basins, 165 lin. ft, 10 in. catch basin pipe, 72 track inlets, 725 lin. ft. 8 in. track inlet pipe. Adjusting 9 pavements, 100 cu. yds. excess grading. For concrete, 25,036 square yards concrete paving, 11,776 sq. yds. vitrified block pavement, 10,878 lin. ft. combined curb and gutter, 5 catch basins, 165 lin. ft. 10 inch catch basin pipe, 72 track inlets, 725 lin. ft. 10 inch catch basin pipe, adjusting 9 pavements, 100 cu. yds excess grading. Certified check $1,000. C. J. Reusche, City Clerk.

Fort Totten, N. Y.—Jan. 15, 1913, 2 p. m. For the construction of macadam roads, cement walks, etc. Information on application to quartermaster.

Bryan, O.—Jan. 9, 1913, 12 m. For furnishing necessary labor and materials for paving West High street between the alley west of Beech street and the west corporation line and the intersection of Beech and Center streets and Beech and Wilson streets and Mulberry street from east line of Main to West line of Union street. Estimated quantity 25,200 square yards. Certified check 10 per cent. John A. Neill, Village Clerk.

Cincinnati, O.—Jan. 17, 1913, 12m. For the improvement of Gum Run road from Zion road to east of Miami road in Miami township. Bond $2,000. Stanley Struble, President.

CONTRACTS AWARDED.

Birmingham, Ala.—A contract was awarded to the C. M. Burkhalter Contracting Co., to grade and macadamize Tappan street for $15,223. The paving will cover seven blocks.

Los Angeles, Cal.—The Barber Asphalt Paving Co. was awarded the contract for the paving and storm drain in Sunset boulevard from Normandie avenue to Hollywood boulevard, $74,564.35.

Los Angeles, Cal.—The contract on creosoted piling for the 670-foot wharf at Wilmington was awarded to the St. Helens Creosoted Piling Co., $21,293.25.

Peoria, Ill.—John McAllister has been awarded the contract for paving with brick State street from Prairie to Glen Oak, $13,527.98. Also for paving Globe street between Main and State streets, $5,703.50.

New Orleans, La.—The following paving contracts have been awarded: The Southern Bitulithic Co. were given the contract for paving of Clico street from Dryades to Magnolia, $29,687.50. The Standard Paving Co. was given the contract for surface drainage on the same street, $19,854.50.

Joplin, Mo.—The city council has awarded the contract for the paving of Sergeant place with liquid bituminous paving to Lloyd Burris, $14,668. The paving will extend from First street to Glenwood place.

Frenchtown, N. J.—Sigafoos & Poor of Riegelsville, have been given the contract for the construction of the first section of the Flemington to Frenchtown macadam road, $77,712.24. The road is more than six miles in length and the excavations necessary is 41,842 cubic yards.

Cincinnati, O.—The contract for the paving of West Eighth avenue, from the old St. Joseph's cemetery to the new St. Joseph's cemetery, a distance of over two miles, was awarded to Ed Ryan. The street is to be paved with bituminous macadam, $60,115.14.

Fremont, O.—The contract for the paving of Buckland avenue has been awarded to Ziegler & Peardon. Estimated cost of improvement, $14,521.

Paris, Tex.—The Shelby Downard Asphalt Co. of Ardmore, Okla., has been awarded the contract for paving West Bonham street with rock asphalt, $43,044.04.

Sherman, Tex.—The Creosoted Wood Block Co., of Dallas, Tex., were given the contract for paving with wood blocks on a 4-inch concrete base, the following streets: Pecan street from Walnut to Crockett, Crockett south to Houston, South Crockett from Lamar to Cherry, Cherry to Walnut. Estimated cost, $32,900.

Terrell, Tex.—The Bert Hawn Construction Co. of Ardmore, Okla., has been given the contract for the paving of Moore avenue from Rockwall to the Texas Midland R. R., and intersecting streets from the Texas & Pacific R. R. to Mash avenue, as follows: Francis, Catherine, Adelia and Virginia. Estimated cost, $60,000.

Norfolk, Va.—The Continental Public Works Co. has been awarded the contract for paving 55,500 square yards of asphalt paving in the old Fifth, Ninth and Tenth Wards at $1.48 a square yard. Also a contract for 18,000 feet of curbing at 49 cents per foot.

Denver, Colo.—A municipal bond issue of $4,000,000 to be utilized in the construction of a network of good roads leading from Denver in all directions and reaching the principal points of interest located within 100 miles of the city is contemplated by the good roads committee. Dr. F. L. Bartleet, Chairman.

CONTEMPLATED WORK.

Elgin, Ill.—The following street improvement by paving is contemplated: St. Charles street, $38,500; Division street, $27,500; Walnut avenue hill, $7,500; Villa street, $60,000; District No. 1 macadam

roadway, $66,000; Milwaukee street pavement, Spring to Center, $3,600; Riverside avenue pavement (alley in rear of opera house and both entrances) $7,000.

Rock Island, Ill.—The city is contemplating the paving with asphalt of Twenty-fifth street from Ninth avenue to Thirteenth avenue, at estimated cost of $12,-273.50.

Waukegan, Ill.—This city is contemplating paving the following streets: Washington street from West street to city limits, estimated cost, $47,000, brick paving; Ash street, from Grand Avenue to Seward, Julian from North street to Ash street; Hickory stret from Grand avenue to Julian; Seward from Ash street to Williams, to be paved with asphaltic concrete, $35,800; St. James street from Glen Rock to Clayton to be paved with creosoted wood blocks at $10,600; also Clayton hill at $4,-100 and Madison hill at $4,665.

Evansville, Ind.—This city is contemplating the expenditure of $20,000 for street improvements. The following streets are to be improved: Wabash avenue; Maryland street from Ninth avenue to St. Joseph; Michigan street from Main to First avenue; Illinois street from Garfield to Governor; Grang avenue from Washington avenue to Monroe street; Walnut street from the Standard Oil Company's plant to Kentucky avenue; Second avenue from Davison to Bond, and Fourth street from Chestnut to Blackford.

Kansas City, Kans.—The plan for the building of the Twenty-third traffic way on the Kansas side of the state line has been ordered. The entire structure will be 38,600 feet long and will cost $800,000.

St. Joseph, Mich.—A $500,000 bond issue for the extending of a net work of good highways through Berrien county has been voted.

Cleveland, O.—An ordinance has been passed authorizing the grading, draining, curbing and paving of the following streets: Lardner avenue to W. Ninety-eighth street; Evarts road from Grand avenue to E. Eighty-ninth street; Walworth avenue from Fifty-eighth to Sixty-fifth street; Wiley avenue from Scranton road to Big Four railway, and Coalgate court from Sixty-fifth to Seventy-third street.

New Philadelphia, O.—The paving of 2½ miles of streets is contemplated as follows: Fair street to North Broadway to Tuscarawas avenue; Tuscarawas avenue from West High street to the corporation line, and West High street from Sixth street to the B. & O. tracks.

Farrel, Pa.—J. Fred Thomas writes us that he is in the market for the following machines and materials: Curbing stone, paving brick, paving filler, paving tools and street cleaning machinery.

Monessen, Pa.—The improvement by grading, paving and curbing Knox avenue, between O'Neida street and Restraven street, is contemplated. Estimated cost, $10,568.48.

Houston, Tex.—The city officials have announced the repaving of Liberty avenue at a cost og $18,000.

Palacios, Tex.—Metagorda county has voted a bond issue to the amount of $100,-000 to be used for the improvement of the public highways.

Smithville, Tex.—A $100,000 bond issue for road improvement has been voted.

Seattle, Wash.—This city is contemplating the paving of Twelfth avenue south to Judkins to Holgate, including Judkins, Atlantic, Massachusetts and Holgate streets, between Twelfth and Thirteenth south, at at estimated cost of $23,778.44. Also of Twenty-third avenue south from Norman to Atlantic at $10,022.94.

Toronto, Can.—A concrete road between Hamilton and Toronto, a distance of about forty miles, is contemplated. Estimated cost, $60,000. W. D. Flatt, Burlington, Can.

SEWERS.

BIDS REQUESTED.

Lebanon, Ind.—Jan. 13, 1913. For the construction of a sewer. Edmund Connor, City Clerk.

Tipton, Ia.—Jan. 15, 7:30 p. m. For the construction of sewers in certain streets and highways. Certified check $500. D. Ketelsen, City Clerk.

Houston, Tex.—Jan. 13, 1913, 12 m. For furnishing of materials and performing labor for the construction of the Fourth ward storm sewers. The work will approximately consist of 3,400 feet of 66-inch sewer, 900 feet of 8-ft. sewer, 5,550 feet of 9-ft. sewer, 1,550 feet of 10-ft. sewer, 46 manholes, 160 catch basins, 4,200 lin. ft. of catch basin connections. Certified check $13,750. H. B. Rice, Mayor.

CONTRACTS AWARDED.

Titusville, Fla.—J. B. McCreary Co., of Atlanta, Ga., was given the contract for the installation of a waterworks system, $27,-000.

Assumption, Ill.—F. E. Kaminske, at his bid of $32,000, has been awarded contract for eight miles of sewer in this city.

Mattoon, Ill.—The contract was let for an extensive improvement of Union District No. 3, a drainage system affecting Numboldt and Seven Hickory townships. The contract includes the laying of two and one-half miles of drain tile, two and one-half miles of open ditch work, the work going to two contractors, the tile work to Thornton & Michales, of this city, and the remainder to Louis & Wetherbolt, of Atwood. The cost of the drain will be $13,363 and the Mattoon firm receiving $9,180 for their part.

Petersburg, Ill.—The Herrick Construction Co., of Carlinville, at their bid of $12,-495 was awarded the contract for putting in the sewerage system in this city.

Clinton, Ia.—Thos. Carey & Son were the lowest bidders for the construction of sewers in District No. 9, at bid of $20,756.

Atchison, Kan.—McGuire & Stanton, of Leavenworth, have been given the contract for constructing the White Clay creek intercepting sewer, at their bid of $31,661.

Detroit, Mich.—John Wagner & Sons, of Cleveland, have been awarded the contract for 4,000 ft. of sewer, at their bid of $121,-600.

Detroit, Mich.—The following contracts on the Morrell street sewer have been awarded: Julian Porath, two sections, $132,852 and $98,829.97; John S. Affeld, one section, $93,616.80; and George Jeynes, one section, $51,183.

Canal Dover, O.—The Van Meter Construction Co., of Zanesville, was awarded the contract to build the city's sewer system for a bid of $16,492.21.

Lorain, O.—F. L. Baxter was the lowest bidder for the construction of a sewer in 28th street, from Toledo avenue to Elyria avenue. Price, $1,732.30.

Houston, Tex.—F. D. Horton & Son were the successful bidders for sanitary sewer work in the First, Fifth and Sixth wards, at the following bids: Fifth ward, $48,-454.40; First and Sixth wards, $29,403.80.

Laredo, Tex.—The contract for the building of a sewer and water plant in Nuevo Laredo was awarded to the El Compania Ferreter, of Monterey. The improvement will cost $150,000.

San Benito, Tex.—J. Scott Brown, of this city, was given the contract for a lo-

cal sewer system. Contract price, $26,636.16.

Anacortes, Wash.—The Atlas Construction Co., of Everett, Wash., were given the contract for the construction of the M avenue sewer, at their bid of $10,907.79.

CONTEMPLATED WORK.

Granite City, Ill.—The construction of an outlet sewer, at an estimated cost of $171,000, is contemplated.

Catonsville, Baltimore, Md. — Eighteen miles of sewer, at an estimated cost of $100,000, is contemplated. Disposal plant to be erected at Westport.

Akron, O.—An ordinance has been passed providing for the improvement of Abel street, from Washington to a point 200 ft. west of Grant street, and Bellows street, from Abel street to Crosier street, by constructing a sewer therein, together with laterals thereto for house connections. Ira A. Priest, clerk of the council.

Kenmore, O.—Sewage disposal and water works bonds to the amount of $170,000 have been voted.

Oklahoma City, Okla.—Sewer system bonds to the amount of $75,000 have been voted.

Du Bois, Pa.—The erection of a sewage disposal plant, to cost $100,000, is contemplated.

Farrel, Pa.—J. Fred Thomas writes us that he is in the market for the following sewer machinery and materials: Castings, catch-basins, manhole covers, municipal castings, vitrified clay pipe, sewer braces, sewer castings, sewer pipe and sewer rods.

Towanda, Pa.—Plans for a sewage disposal plant and system have been approved. Estimated cost, $96,510.

Austin, Tex.—A bond issue to the amount of $100,000, for sewer improvement, has been voted.

North Yakima, Wash.—Plans for the $250,000 sewer system have been completed by City Engineer N. A. Gilman. The construction of a sewage disposal plant is also contemplated.

North Yakima, Wash.—The construction of a sewer system to cost $274,000, including a 20-acre disposal plant, a main outlet sewer along the south city limits and two intercepting pipe lines running north in the east and west parts of the city, is contemplated.

WATER WORKS.

CONTRACTS AWARDED.

LaCrosse, Wis.—The following contracts in connection with the construction of the new well system have been awarded: Pumping station, LaCrosse Construction Co., $50,834; chimney, Weber Chimney Co., $2,475; low reservoir, Western Construction Co., $7,500; pipes, United States Cast Iron and Foundry Co., $14,690; valves, Chapman Valve Co., $2,245; high reservoir, J. W. Turner Improvement Co., $74,461; interior piping, John R. Kehn Co., $7,770.

CONTEMPLATED WORK.

Burlingame, Cal.—An election here resulted in favor of issuing water works system bonds to the amount of $175,000.

Suisun, Cal.—A $20,000 bond issue for the improvement of the municipal water system has been voted.

Aurora, Ill.—The voters of Hinckley county recently voted in favor of issuing $12,000 bonds for the purpose of establishing a new water plant.

Chicago, Ill.—The Allis Chalmers Company, of Milwaukee, Wis., has been given the contract for designing, erecting and constructing at the 14th street pumping station, Harrison street pumping station, Central avenue pumping station and Springfield avenue pumping station, one horizontal centrifugal pump, driven by direct connected horizontal condensing steam turbine, with all auxiliaries, accessories, etc. Contract price, $83,500.

Evanston, Ill.—The election here resulted in favor of issuing water works bonds to the amount of $180,000. J. F. Hahn, clerk.

Muscatine, Ia.—This city is contemplating the expenditure of $100,000 for the improvement of the water works system.

Topeka, Kan.—This city has voted bonds to the amount of $45,000 for a water and lighting plant.

Frederick, Md.—A $60,000 bond issue to purchase the water-shed contiguous to the sources of the city's water supply and build a storage reservoir has been voted. Dr. Ira J. McCurdy, city health officer.

St. Paul, Minn.—This city is contemplating a bond issue to the amount of $1,000,000 for improvements and extensions to the water service.

East Liverpool, O.—A $250,000 bond issue for a mechanical filtration plant and other improvements to the water works plant has been voted.

Elmore, O.—A bond issue to the amount of $20,000, for municipal water plant, has been voted.

Frankfort, O.—A bond issue to the amount of $12,000 has been voted for a municipal water plant.

Sapulpa, Okla.—This city has voted $75,000 in bonds for water works extensions and other municipal improvements.

Freewater, Ore.—This city has voted in favor of issuing water pipe bonds to the amount of $12,000.

Homestead, Pa.—An $86,000 bond issue, for the construction of a filtration plant and the improvement of the Homestead water works, has been voted.

Galveston, Tex.—Water works bonds to the amount of $125,000 have been voted.

Marlin, Tex.—Water works bonds to the amount of $25,000 have been voted.

Montgomery, Tex.—A bond issue of $10,000 for water works plant will be voted upon in the near future.

Huntington, W. Va.—An $800,000 water system in this city is contemplated. Chas. R. Wilson, water works commissioner.

Mukwonago, Wis.—Water works system bonds to the amount of $14,000 have been voted.

Hamilton, Can.—A new reservoir, estimated cost $300,000, is contemplated. A. F. Macallum, city engineer.

BRIDGES.

BIDS REQUESTED.

Cincinnati, O.—Jan. 17, 1913, until 12 m., for the following work: Repairing floor of iron bridge over Great Miami river at Elizabethtown, in Whitewater township. Certified check $500. Stanley Struble, president of city council.

Cleveland, O.—Jan. 15, 1913, for the construction of bridge work, sidewalk and curb, South Rocky River bridge, in Rockport township. John F. Goldenbogen, clerk.

CONTRACTS AWARDED.

Mobile, Ala.—The Nashville Bridge Company, of Nashville, Tenn., has been awarded the contract for a bridge over Dog river near its mouth. Price, $15,200.

Little Rock, Ark.—Hannan & Hickey, of St. Louis, have been given the contract for the construction of the Third street viaduct. Contract price, $83,034.

Pineville, Ky.—Contract for the bridge across Cumberland river was given to the Roanoke Bridge Company at their bid of $15,000.

St. Joseph, Mo.—Contracts for building five concrete culverts on the road between Faucett and Dearborn were awarded as follows: C. H. Belcher was given the contract for the bridge at J. M. Radeck place, $3,185; J. A. Campbell place, $1,780; W. T. Maget place, $2,720. The contract for the culvert at the S. D. Hamilton place was awarded to the DuBois Construction Co. for $850, and for the one at the J. B. Stafford farm, $2,050.

Phoenix, N. Y.—Burleigh & Ingersoll, of Rochester, have been given the contract for the state's portion of the proposed river bridge at $198,000.

Lawton, Okla.—The Midland Bridge Co., of Kansas City, have been awarded the contract for the construction of 15 steel bridges, at their bid of $13,480.

Edmonton, Alta.—The contract for a bridge across the Saskatchewan, to cross at the foot of Fifth street, has been awarded to the Lyall-Mitchell Company, at $79,898.

Ottawa, Ont., Can.—An $80,000 contract has been let to the Canadian Bridge Co., for construction of steel bridge work over the Mamagush river and Canyon creek.

CONTEMPLATED WORK.

Rockford, Ill.—A new bridge at Morgan street, which will cost approximately $40,000, is contemplated.

Streator, Ill.—After much discussion, it has been decided to advertise for bids calling for bridges of both steel and concrete construction across Vermillion river, on the Deer Park road. Approximate cost, $23,000.

Minneapolis, Minn.—A concrete bridge, to cross the Mississippi river from the foot of Third avenue S. to a point just east of the old Exposition building, at estimated cost of $650,000 to $700,000, is contemplated.

Hamilton, Can.—Construction of a steel and concrete bridge over low level road is contemplated. Estimated cost, $25,000.

GARBAGE DISPOSAL.

Peoria, Ill.—The purchase of ten garbage wagons, at an estimated cost of from $5,000 to $7,000, is contemplated.

Waukegan, Ill.—The erection of a $15,000 garbage incinerator is contemplated.

St. Joseph, Mo.—This city is contemplating the installation of a municipal incinerator or garbage reduction plant.

Janesville, Wis.—James Corse & Co. have been awarded the contract for the building of the new garbage incinerator, at their bid of $21,000.

BUILDINGS.

CONTRACTS AWARDED.

Augusta, Ga.—The King Lumber Company, of Charlottesville, Va., have been given the contract for the Barrett and Lamar wings of the new city hospital, the amount of their bid being $122,029.

Waukegan, Ill.—The American Construction Co. has been given the contract for the new federal building, at $70,000.

Philadelphia, Pa.—J. E. & A. L. Pennock have been given the contract for the remodeling of the United States postoffice in Harrisburg, at a cost of $100,000.

Salt Lake City, Utah.—The James Stewart Co. New York, at bid of $1,106,000, was the lowest bidder on the construction of Utah's capitol building.

CONTEMPLATED WORK.

Chicago, Ill.—The erection of a $75,000 Immigration Station is contemplated.

Chicago, Ill.—This city is contemplating the erection of a $3,000,000 hospital.

Kewanee, Ill.—Henry County is contemplating the building of a 120-room infirmary to cost $90,000.

Ft. Wayne, Ind.—A bond issue for a Municipal Convention Hall to the amount of $75,000 has been voted.

Garrett, Ind.—W. W. Mount, City Clerk, writes us that his city is contemplating the erection of a new city building early in the spring and that he is anxious to get in touch with some good, reliable architects.

Dayton, O.—A $200,000 bond issue for an addition to the Stivels Manual Training School has been voted.

Atoka, Okla.—This county has voted bonds for the erection of a court house to cost $100,000.

Denison, Tex.—A bond issue to the amount of $100,000 has been voted for the erection of a new high school building.

AUTOMOBILES AND MOTOR EQUIPMENT.

Denver, Colo.—A fire truck of the aerial type, costing $5,000, is to be purchased for the fire department by Commissioner of Supplies Thomas.

Wilmington, Del.—The purchase of an auto fire truck at an estimated cost of $10,000 to $11,000 is contemplated. One of the specifications of the proposed truck will be that it will have an 85 ft. extension ladder.

Champaign, Ill.—A $5,000 bond issue for the purchase of an automobile fire truck and equipment consisting of 500 feet of hose has been voted.

Chicago, Ill.—The purchase of an auto for use in the detective department is contemplated.

Baltimore, Md.—The city is contemplating converting four horse-drawn engines into automobile engines and rebuilding the fireboat Cataract at an estimated cost of $65,000.

Elmira, N. Y., has decided to buy a motor hook and ladder truck. It is to be equipped with a 70 horse power engine and the estimated cost is $6,000.

Toledo, O.—A $200,000 bond issue to be used in replacing the horse-driven apparatus and patrol wagons in the fire and police departments with motor-driven apparatus has been voted. Safety Director, Mooney.

East Liverpool, Pa.—The entire fire department of this city is to be motorized. The first appropriation of $33,000 bonds for this purpose has been authorized.

Wilkes-Barre, Pa.—The purchase of all motor-driven equipment for the fire department is contemplated.

Galveston, Tex.—A $75,000 bond issue for the purchase and equipment of a fire station has been voted.

Montreal, Que.—The three road superintendents of the road department will be supplied with small automobiles costing about $2,000 each.

LIGHTING.

CONTEMPLATED WORK.

Elgin, Ill.—A $150,000 bond issue for the municipal lighting plant is contemplated.

Whiting, Ia.—A bond issue to the amount

of $10,000 for the purpose of installing an electric light and power system is contemplated.

Topeka, Kans.—This city is contemplating the installation of a great white way. Estimated cost $10,000.

Tecumseh, Nebr.—The installation of a municipal electric light plant is contemplated.

Arcade, N. Y.—A bond issue to the amount of $9,500 to purchase an additional unit for the electric light plant has been voted.

East Liverpool, O.—A bond issue to the amount of $60,000 for a municipal electric light plant has been voted.

Camden, Pa.—This city is contemplating the erection of a municipal lighting plant at an estimated cost of $300,000.

New Castle, Pa.—A bond issue to the amount of $200,000 has been voted for the erection and installation of an electric light plant.

Sharon, Pa.—Sharon will build a municipal lighting plant which will cost between $65,000 and $81,000.

STREET SIGNS.

Phoenix, Ariz.—The erection of road and street signs through the states of Arizona and New Mexico is contemplated.

Chicago, Ill.—The City Council has appropriated $54,000 for use in the erection of new street signs for this city.

Davenport, Ia.—About 2,000 street signs to be erected in the residential section of this city is contemplated. City is at the present time placing new signs in the business district.

Minneapolis, Minn.—This city is contemplating the erection of signs to be posted in the main roads and interurban lines, showing the location of the city limits.

New York, N. Y.—This city is going to put up 1,200 improved street signs in Manhattan at an expense of $9,000.

Canton, O.—The contract for new street signs will be let in the near future, according to Service Director Ruff.

Cincinnati, O.—A $10,000 appropriation for the installation of street signs throughout the city is contemplated.

Lima, O.—This city is contemplating the installation of street signs to be placed on iron posts 10 ft. high at the intersections of streets in the business district; also the placing of smaller signs in the residence district. These, however, will be attached to the corner houses.

Salem, O.—The placing of street designations at the intersections throughout the city is contemplated.

Wilkes-Barre, Pa.—A question soon to be considered by the street committee will be the adoption of a suitable street sign, to replace those that have been destroyed and to provide for new streets and lanes. Fully 2,000 will be needed.

Edmonton, Alta.—The renaming of 53 streets in this city is contemplated.

PARKS.

CONTEMPLATED WORK.

Washington, D. C.—A park to be located at the west end of the Q street bridge, to be built over Rock creek, and a highway to extend from the proposed park along the boundary of Oak Hill Cemetery to 29th and R streets, is contemplated. The area of land proposed is 142,500 square feet, or approximately 3.3 acres. Estimated cost, $31,000.

Chicago, Ill.—Secretary Mulger has been instructed to ask for bids for new buildings to be erected in West Park No. 6 and No. 7. Both parts will also have swimming pools and assembly halls. Estimated cost $250,000.

Chicago, Ill.—An outer park system for Chicago, to embrace 30,000 acres and to cost between $15,000,000 and $20,000,000, has been declared by Alderman Albert W. Beilfuss of the Park and Playgrounds Committee to be assured in the coming year.

Chicago, Ill.—The West Park Board has appropriated $25,000 for a new playground and natatorium in the south of Humboldt Park.

Waterloo, Ia.—The following park improvements are contemplated: Erect bandstand, with basement, in Lincoln Park. In the basement will be provided public comfort stations for men and women. Enlarge the Zoo at Cedar River Park by adding buildings for animals and increasing the species. Erect refreshment stands at the bathing beach to be under the sole control of the commissioners for the sale of lunches, cigars and soft drinks. Add new species of plants and flowers in the park and increase the floral areas. Oil the driveways in Cedar River and Prospect Parks. Develop Courtlandt and Byrnes Parks, which lie on opposite sides of the river below the packing plant. Place cable across the river and install ferry service between these two tracts. Take over the public square in Highland and beautify it.

Melrose, Mass.—Park and site purchase bonds to the amount of $9,000 has been voted.

Kalamazoo, Mich.—This city has purchased two blocks of land in the heart of the city and will convert the property into a park.

St. Joseph, Mo.—This city is contemplating the establishing of a park in the area bound by Holmes and Douglas and Thirteenth and Eighteenth streets.

Cleveland, O.—Playgrounds will be established at Woodland Hills Park, Fairfield Park and in the Italian colony on Mayfield road, in addition to the ones conducted last summer. The Woodland Hills playground will be designed especially for smaller children. The playground at Fairfield Park will be on the site of the old Kentucky street water works reservoir, now being leveled.

Toledo, O.—A $175,000 bond issue for park and boulevard purposes has been voted.

Muskogee, Okla.—An election here resulted in favor of issuing park bonds to the amount of $150,000.

Shawnee, Okla.—Park bonds to the amount of $50,000 have been issued.

Connellsville, Pa.—The leasing of Soisson park and converting it into a summer and winter amusement place, with a swimming pool, dance hall and skating pond, is contemplated.

Pittsburgh, Pa.—Westmoreland Country Club will spend about $50,000 for improvements to its golf grounds.

Providence, R. I.—Park bonds to the amount of $500,000 have been issued.

New Philadelphia, O.—The paving of 2½ miles of streets is contemplated as follows: Fair street to North Broadway to Tuscarawas avenue; Tuscarawas avenue from West High street to the corporation line, and West High street from Sixth street to the B. & O. tracks.